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JEL Classification: L13, L42, L51, L82

Keywords: vertical integration, foreclosure, double marginalization, raising rivals' costs, cable television

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The Welfare Effects of Vertical Integration in Multichannel Television Markets*

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October 2017

Abstract

We investigate the welfare effects of vertical integration of regional sports networks (RSNs) with programming distributors in U.S. multichannel television markets. Vertical integration can enhance efficiency by reducing double marginalization and increasing carriage of channels, but can also harm welfare due to foreclosure and incentives to raise rivals' costs. We estimate a structural model of viewership, subscription, distributor pricing, and affiliate fee bargaining using a rich dataset on the U.S. cable and satellite television industry (2000-2010). We use these estimates to analyze the impact of simulated vertical mergers and divestitures of RSNs on competition and welfare, and examine the efficacy of regulatory policies introduced by the U.S. Federal Communications Commission to address competition concerns in this industry.

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1 Introduction

The welfare effects of vertical integration is an important but controversial issue. The theoretical literature on the pro- and anti-competitive impacts of vertical integration is vast (cf. Perry, 1990; Rey and Tirole, 2007; Riordan, 2008; Bresnahan and Levin, 2013), and typically contrasts potential efficiencies related to the elimination of double marginalization (Spengler, 1950) and the alignment of investment incentives (Willamson, 1985; Grossman and Hart, 1986) with the potential for losses arising from incentives to foreclose rivals and raise their costs (Salop and Scheffman, 1983; Krattenmaker and Salop, 1986; Hart and Tirole, 1990; Ordover et al., 1990). Despite a growing literature, empirical evidence on the quantitative magnitudes of these potential effects, and the overall net welfare impact, is still limited.

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This paper quantifies the welfare effects of vertical integration in cable and satellite television in the context of high-value regional sports programming in the U.S. Whether the ownership of content by distributors harms welfare has been at the heart of the debate over recently approved (e.g., Comcast and NBC in 2011), abandoned (e.g., Comcast and Time Warner in 2015), and proposed (e.g., AT&T and Time Warner in 2016) mergers in the television industry. The attention that these mergers have attracted is partly due to the industry's overwhelming reach and size: over 80% of the approximately 120 million television households in the U.S. subscribe to multichannel television, and the mean individual consumes about four hours of television per day.[1] Regional sports programming is a large part of this industry, receiving $4.1 billion out of over $30 billion per year in negotiated affiliate fees paid by distributors to all content providers, and an additional $700 million per year in advertising dollars.[2]

Our focus on the multichannel television industry, and in particular regional sports programming, is driven by several factors that create empirical leverage to address this question. First, there is significant variation across the industry in terms of ownership of regional sports content by cable and satellite distributors, also referred to as multichannel video programming distributors (MVPDs). Although this variation is primarily at the national-level for most channels, regional sports networks (RSNs) are present in smaller geographic areas, and there is useful variation in ownership patterns both across regions and over time. Additionally, the industry is the subject of significant regulatory and antitrust attention in addition to merger review, including the application of "program access rules" and exceptions to this rule, such as the "terrestrial loophole" which exempted certain distributors from supplying integrated content to rivals.

There are two key components of our analysis. The first is the construction of a comprehensive dataset on the U.S. multichannel television industry, collected and synthesized from numerous sources. The dataset comprises aggregate and individual-level consumer viewership and subscription patterns, channel ownership and integration status, and prices, quantities, and channel carriage "lineups" for cable and satellite bundles at the local market level for the years 2000 to 2010.

The second component is the specification and estimation of a structural model of the multichannel television industry that captures consumer viewership and subscription decisions, MVPD pricing and carriage decisions, and bargaining between MVPDs and content providers. We significantly extend the model of Crawford and Yurukoglu (2012) by constructing an empirical framework suitable for the analysis of vertical integration and mergers. Our model incorporates integrated firms' incentives to foreclose rivals' access to inputs, the potential for double marginalization, and the possibility of imperfect coordination and internalization within an integrated firm. This last feature is one of the novel aspects of our approach, as we estimate, rather than impose, the degree to which firms internalize the profits of integrated units when distributors make pricing and channel carriage decisions, and channels decide to supply or foreclose rival distributors. Given our

[1] `http://www.nielsen.com/us/en/insights/news/2016/nielsen-estimates-118-4-million-tv-homes-in-the-us--for-the-2016-17-season.html`, `http://www.nielsen.com/content/dam/corporate/us/en/reports-downloads/2016-reports/q3-2016-total-audience-report.pdf`, accessed on March 13, 2016.

[2] SNL Kagan.

goal to evaluate whether vertical integration improves or worsens welfare due to improvements in internal efficiency or increases in foreclosure of rivals, taking this approach avoids building into our model the assumption that these two effects actually happen to the extent predicted by theory. For example, only very simple views of the firm imply that integrated firms behave as if they are under unitary control, and managers of integrated firms may well either not consider or over-react to the gains that can be reaped from foreclosure.

An important input into identifying these effects is our estimates of the change in distributor profits from the addition or removal of an RSN from any of its programming bundles. We use the relationship between distributors' market shares and channel carriage, as well as observed viewership patterns and negotiated affiliate fees, to infer the values consumers place on different channels. With the estimated profit effects in hand, the pro-competitive effects of vertical integration are largely identified from the degree to which RSN carriage is higher for integrated distributors than would be implied by the RSN's profitability to the distributor; the anti-competitive foreclosure effects are identified by lower RSN supply to downstream rivals of integrated RSNs.

We find that integrated distributors substantially but incompletely internalize the effects of their pricing and carriage decisions on their upstream channels' profits: we estimate that only \$0.79 of each dollar of profit realized by its integrated partner is internalized when an integrated MVPD makes pricing and carriage decisions, or when integrated MVPDs and RSNs bargain with each other. We also find that integrated RSNs fully (and perhaps more than fully) take into account the benefits their downstream divisions reap when a rival distributor is denied access to the RSN's programming.

After estimating our model, we leverage its structure to examine the mechanisms through which pro- and anti-competitive effects of vertical integration might occur. We do so by simulating vertical mergers and divestitures for 26 RSNs that were active in 2007, and examining their effects on equilibrium firm (carriage, pricing, affiliate fee bargaining and supply) and consumer (subscription, viewership) decisions. We consider integration scenarios when program access rules—which ensure that non-integrated rival distributors have access to integrated content—are effectively enforced, and when they are not. When program access rules are enforced, our counterfactual simulations capture the pro-competitive effects of integration from improved internalization of pricing and carriage decisions within the integrated firm. When program access rules are not enforced, our simulations allow as well for integrated (typically cable) distributors to engage in foreclosure, denying access to or charging higher prices for their owned RSN to non-integrated rival (typically satellite) distributors.

Our results highlight the importance of program access rules in determining the effects of vertical integration. In counterfactual simulations that enforce program access rules, we find that vertical integration leads to significant gains in both consumer and aggregate welfare. These benefits arise due to both lower cable prices (through the reduction of double marginalization) and greater carriage of the RSN. Averaging results across channels, we find that integration of a *single* RSN with effective program access rules in place would reduce average cable prices by 1.2% (\$0.67) per subscriber per month in markets served by the RSN, and increase overall carriage of the RSN by 9.4%. Combined, these effects would yield, on average, a \$0.43 increase in total welfare per household from all television services, representing approximately 17% of the average consumer willingness to pay for a single RSN. We also predict that consumer welfare would increase.

When program access rules are instead not enforced, we find that—at the estimated lower bound for our "rival foreclosure" parameter—rival distributors would be denied access to an integrated RSN in 4 of out of 26 cases; for the other 22 cases, the rival distributors continue to have access but pay on average 18% higher affiliate fees than if program access rules were effectively enforced. Together, failure to enforce program access rules leads to a reduction in both consumer and total welfare of 1-2% of the average consumer willingness to pay for a single RSN. We find that the loss is significantly larger in cases in which the rival distributors are denied access. The foreclosure of satellite distributors tends to occur when the RSN is owned by a cable distributor whose market share is large in the geographic region served by the RSN. Our counterfactual results suggest that satellite distributors are excluded from carrying the RSN when the integrated cable distributor's share of households that it could serve exceeds approximately 85%.

On net, we find that the overall effect of vertical integration in the absence of effective program access rules—allowing for both efficiency and foreclosure incentives—is to increase consumer and total welfare on average, resulting in (statistically significant) gains of approximately \$0.38-0.39 per household per month, representing 15-16% of the average consumer willingness to pay for an RSN. In the 4 markets in which rival distributors would be denied access, gains are quite small and cannot be distinguished from zero, while consumer and total welfare gains are positive and statistically significant in the 22 cases in which exclusion does not occur in response to vertical integration. Finally, stemming from the foreclosure and raising rivals' costs effects discussed above, rival distributors are predicted to be worse off; satellite surplus, in particular, falls 2.2% when vertical integration occurs with program access rules, and by 3.2% without these rules in place.

Despite the richness of our empirical model, the effects that we document are only partial. Most importantly, our model and analysis does not allow vertical integration to influence investments made by RSNs and MVPDs (both those that integrate and their rivals).[3] As emphasized in the literature on investment effects of vertical integration (Bolton and Whinston, 1991; Hart, 1995), the direction of these effects on consumer and aggregate surplus are ambiguous a priori (and remain an important topic for future research).

Related Literature. Previous work studying the cable industry, including Waterman and Weiss (1996), Chipty (2001), and Chen and Waterman (2007), have primarily relied on reduced form cross-sectional analyses for a limited subset of channels and found that integrated cable systems are more likely to carry their own, as opposed to rival, content. An exception is Suzuki (2009) who studies the 1996 merger between Time Warner and Turner broadcasting. His analysis uses

[3]For example, the predicted negative impact on satellite distributors raises the possibility that widespread integration by cable distributors of RSNs might impact satellite distributors' effectiveness as a competitor to cable to a greater extent than admitted for in our analysis.

time series variation in ownership, finding that vertically integrated channels were more likely to be carried post merger and rival non-integrated channels were less likely to be carried.[4] These studies cannot, however, separate efficiency from foreclosure incentives, nor can they provide estimates of overall welfare effects. For example, reduced carriage of rival non-integrated channels could reflect either foreclosure effects or the impact of efficient increases in carriage of integrated channels when channels are substitutes. We complement this literature on vertical integration in the cable industry in two ways. First, building a structural model allows us to make welfare statements about the impact of vertical integration and identify the mechanisms through which the effects work. Second, we leverage a richer, panel dataset on consumer viewership and bundle subscription, and the pricing, carriage, and bargaining decisions of channels and distributors.

This paper also adds to the growing empirical literature on the effects of vertical integration and other vertical arrangements (e.g., Shepard, 1993; Hastings, 2004; Hastings and Gilbert, 2005; Villas-Boas, 2007; Mortimer, 2008; Houde, 2012; Lee, 2013; Conlon and Mortimer, 2015; Asker, 2016). As noted by Bresnahan and Levin (2013), despite a voluminous literature examining when vertical integration occurs, relatively few papers have attempted to examine its positive and normative effects.[5] We build on existing approaches by estimating a model that explicitly incorporates avenues for vertical integration to improve the efficiency of pricing and channel carriage decisions, and to generate foreclosure or raise costs of rival distributors; and by providing estimates of the degree to which integrated firms, in practice, act on each of these incentives.[6] Using these estimates, we are then able to estimate the net welfare impact of vertical integration that trades off these pro- and anti-competitive effects. Finally, we develop methods for the estimation and simulation of counterfactual scenarios in vertical markets characterized by bilateral oligopoly and negotiated prices that can be applied in other related settings.[7]

Road Map. The rest of this paper is organized as follows. In the next section, we provide an overview of the U.S. cable and satellite industry and regional sports networks, and describe the data that we use in our analysis. We present our model of the industry in Section 3, and detail its estimation and our parameter estimates in Sections 4 and 5. We then assess the welfare effects of vertical integration by discussing the implementation of and findings from our counterfactual simulations in Section 6 and conclude in Section 7.

2 Institutional Detail and Data

Our study analyzes the U.S. cable and satellite industry for the years 2000 to 2010 and focuses on the ownership of "Regional Sports Networks" (RSNs) by cable and satellite distributors. In this

[4] See also Caves et al. (2013) who provide evidence that RSN affiliate fees are correlated with downstream MVPD footprints.

[5] Notable exceptions include Ciliberto (2006), Hortaçsu and Syverson (2007) and Atalay et al. (2014, 2017).

[6] See also Michel (2013), who examines whether firms jointly maximize profits following a horizontal merger.

[7] For example, Ho and Lee (2017) adapt techniques developed in this paper to examine hospital and insurance competition in health care markets.

section, we describe the industry's structure, RSNs, and regulatory policy during this period. We then discuss the data that we use to estimate the model. The tables referenced in this section are contained in Appendix A.

2.1 Industry Structure

In the time period that we study, the vast majority of households in the U.S. were able to subscribe to a multichannel television bundle from one of three downstream multichannel video programming distributors (MVPDs): a local cable company (e.g., Comcast, Time Warner Cable, or Cablevision) or one of two nationwide satellite companies (DirecTV or Dish Network).[8] Cable companies transmit their video signals through a physical wire whereas satellite companies distribute video wirelessly through a south-facing satellite dish attached to a household's dwelling. The majority of distributors' revenue comes from selling subscriptions to three different bundles of programming: a limited basic bundle which retransmits over-the-air broadcast stations, an expanded basic bundle containing 40-60 of the most popular channels available on cable (e.g., AMC, CNN, Comedy Central, ESPN, MTV, etc.), and a digital bundle containing between 10 to 50 more, smaller, niche channels. Our analysis focuses on the provision of multichannel programming, and does not explicitly consider the bundling or sale of Internet or phone services by cable or satellite distributors.[9]

Downstream distributors negotiate with content producers over the terms at which the distributors can offer the content producers' channels to consumers. These negotiations usually center on a monthly per subscriber "affiliate fee" that the downstream distributor pays the channel for every subscriber who has access to the channel, whether the subscriber watches it or not.[10]

2.2 Regional Sports Networks

RSNs carry professional and college sports programming in a particular geographic region. For example, the New England Sports Network (NESN) carries televised games of the Boston Red Sox and the Boston Bruins. Metropolitan areas can have multiple RSNs. For example, in the New York City metropolitan area, there are four different RSNs: Madison Square Garden (MSG), MSG

[8] Telephone MVPDs (primarily consisting of AT&T and Verizon) did not enter a significant number of markets until 2007, at which point combined they had approximately 1.2 million subscribers according to financial filings; by the end of 2010, they had 6.9 million out of 100.8 million total MVPD subscribers (FCC, 2013).

[9] This shortcoming arises for data and computational reasons. For reference, in 2007, according to the U.S. Census Bureau Service Annual Survey, cable and other program distributors received 60% of their revenues from multichannel programming distribution services, 16% of revenues from Internet access services, and 6% from telephony services; other revenue sources included air time and installation and rental of equipment. During our sample period, Internet access (telephony) services grew from 2% (1%) of cable distributor revenues in 2000 to 17% (8%) by 2010 while programming revenues fell from 77% to 57%. While the fixed effects and unobservable demand shifters ($\boldsymbol{\xi}$) that we introduce later in our demand analysis should partially account for differences in Internet provision across distributors, our counterfactuals will miss any effects of vertical integration that arise because of induced changes to distributors' Internet packaging or pricing.

[10] As discussed in Crawford and Yurukoglu (2012), payments between distributors and content providers are primarily in the form of linear fees; fixed fee monetary transfers are rare, and if they exist, they are typically negligible relative to the total payment.

Plus, SportsNet NY, and Yankees Entertainment and Sports (YES). Some RSNs also serve multiple metropolitan areas. For example, the Sun Sports network holds the rights to the Miami Heat and the Tampa Bay Rays, amongst others.

According to industry estimates, RSNs command the second-highest per subscriber affiliate fees after the national sports network ESPN. For example in 2010 Comcast SportsNet (CSN) Philadelphia had per subscriber monthly fees that averaged $2.85 per month whereas highly-rated national channels such as Fox News, TNT, and USA were around $1 per subscriber per month (and ESPN over $4 per subscriber per month).

RSNs are sometimes owned by entities that also own downstream cable or satellite distributors. Figure 1 shows RSNs' ownership affiliations with downstream distributors over a 13-year period for the RSNs in our data that were active in 2007. Many RSNs are owned, to some degree, by a downstream distributor. For example, in 2007, downstream distributors had ownership interests in 16 of these RSNs. The cable MVPDs that owned RSNs are Comcast, Cablevision, Cox, and Time Warner. DirecTV, the largest satellite operator (and second-largest U.S. MVPD), indirectly had stakes in numerous RSNs through its partial owners News Corporation and Liberty Media Corporation.[11] Ownership affiliations also vary over time, as RSNs may be (partially) acquired, divested, or sold to other distributors.

2.3 Regulatory Policy

There are several key features of the regulatory environment for RSNs, and vertically integrated content more generally, that are pertinent for our study. During our sample period, vertically integrated firms were subject to the "Program Access Rules" (PARs), which required that vertically integrated content be made available to rival distributors at non-discriminatory prices (subject to final-offer arbitration if necessary). The PARs only applied to content that was transmitted to MVPDs via satellite. This covered all national cable channels (which need satellite transmission to cost-effectively reach cable systems around the country) and most RSNs. However, a handful of RSNs transmitted their signal terrestrially (usually via microwave), thereby avoiding the jurisdiction of the PARs. This was called the "terrestrial loophole" in the Program Access regulation. In 2007, only two long-standing cable-integrated RSNs were able to leverage the terrestrial loophole: Comcast SportsNet in Philadelphia and SD4 in San Diego (owned by Cox Cable); in both cases, the channel was not provided to satellite distributors.[12] As a result, Major League Baseball (MLB), National Basketball Association (NBA), and National Hockey League (NHL) games in Philadelphia were only available on cable and not on DirecTV or Dish Network. Similarly in San Diego, MLB games were available only through cable. This feature of regulatory history will be an important

[11] News Corporation and Liberty Media both had a partial ownership stake in DirecTV starting in 2003; at the beginning of 2008, News Corporation completed an asset swap with Liberty in which News traded its stake in DirectTV for Liberty's stake in News.

[12] Time Warner Cable also employed the terrestrial loophole from 2006 to 2008 for the (then relatively new) Charlotte Bobcats NBA franchise by placing some their games on News 14, a terrestrially delivered regional news channel.

Figure 1: RSN Ownership

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Comcast	**Liberty/News**		**Liberty/Cablevision/News**		**Comcast**		**Comcast/Charter**		**Comcast/Cablevision**		**Comcast/News**		
Comcast SportsNet Bay Area	35/23/35	6/23/64	13/23/57	13/23/57	13/23/57	13/30/57	7/60/33	7/60/33	7/60/33	60/34	60/40	60/40	67/30
Comcast SportsNet California							100	100	100	100	100	100	100
Comcast SportsNet Chicago								30	30	30	30	30	30
Comcast SportsNet Mid-Atlantic	17/17	3/31	3/31	100	100	100	100	100	100	100	100	100	100
Comcast SportsNet New England	10/10/23	2/23/18	4/23/16	4/23/16	4/23/16	4/30/16	4/30/16	50/50	50/50	100	100	100	100
Comcast SportsNet Northwest										100	100	100	100
Comcast SportsNet Philadelphia	46	46	53	53	78	78	78	78	84	85	85	85	85
Comcast/Charter Sports Southeast		100	72	72	72	72	77/23	69/23	70/24	74/26	74/26	74/26	75/19
News Corp	**Liberty/News**		**Liberty/Cablevision/News**		**Liberty/Comcast/Cox/News**		**Liberty/Cox/News**		**News**				
Fox Sports Detroit	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	18/82	100	100	100
Fox Sports Florida	10/10/23	1/14/6	7/45/33	7/45/33	7/60/33	7/60/33	7/60/33	18/82	18/82	16/84	100	100	100
Fox Sports Midwest	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Fox Sports North	-	-	-	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Fox Sports Ohio	20/45/20	3/45/37	7/45/33	7/45/33	7/60/33	7/60/33	7/60/33	18/82	18/82	16/84	100	100	100
Fox Sports South	44/44	7/81	8/80	10/78	11/77	13/75	14/74	15/73	17/71	17/71	88	88	88
Fox Sports Southwest	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Fox Sports West	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Prime Ticket	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Sun Sports	28/13/5/28	5/16/5/52	19/16/5/49	19/16/5/49	11/5/49	11/6/49	11/49	11/49	11/49	11/50	60	60	60
Liberty	**Liberty/News**		**Liberty**										
Root Sports Northwest	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Root Sports Pittsburgh	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Root Sports Rocky Mountain	50/50	08/92	18/82	18/82	18/82	18/82	18/82	18/82	18/82	16/84	100	100	100
Cablevision	**Cablevision**		**Liberty/Cablevision/News**										
Madison Square Garden Network (MSG)	20/45/40	3/45/37	7/45/33	7/45/33	7/45/33	7/60/33	7/60/33	100	100	100	100	100	100
MSG Plus	20/45/40	3/45/37	7/45/33	7/45/33	7/45/33	7/60/33	7/60/33	100	100	100	100	100	100
Cox	**Cox**												
Channel 4 San Diego	100	100	100	100	100	100	100	100	100	100	100	100	100
Cox Sports Television					100	100	100	100	100	100	100	100	100
Time Warner	**Comcast/TimeWarner**												
SportsNet New York									8/27	8/27	8/27	8/27	8/27
Independents / Other													
Altitude Sports & Entertainment							-	-	-	-	-	-	-
Mid-Atlantic Sports Network (MASN)								-	-	-	-	-	-
New England Sports Network (NESN)	-	-	-	-	-	-	-	-	-	-	-	-	-
Yankees Entertainment & Sports (YES)					-	-	-	-	-	-	-	-	-

Notes: Reported are the vertical ownership stakes held by major distributors of cable and satellite television service for the Regional Sports Networks (RSNs) in our data that were active in 2007. Ownership data were collected by hand from company stock filings and industry sources. The ownership share for each distributor is reported and individual owners (or combinations of owners) are shaded according to the channel-specific legend located in the first line of each potential owner. Black bars correspond to a year in which the given RSN is not active (i.e., has not yet entered or has exited the market). Hyphens correspond to years of active operation for an RSN without a vertical ownership affiliation.

source of identifying variation in our econometric estimation.

The PARs were introduced in 1992 and required renewal by the FCC every five years. They were allowed to lapse in 2012 and replaced by rules giving the Commission the right to review *any* programming agreement for anti-competitive effects on a case-by-case basis under the "unfair acts" rules the Commission established in 2010 (FCC, 2012). The new case-by-case rules explicitly include a (rebuttable) presumption that exclusive deals between RSNs and their affiliated distributors are unfair. During our sample period (2000-2010), most integrated RSNs outside of loophole markets had agreements to be carried by all MVPDs. However, even though PARs were in effect, there were a few instances in which a cable-owned RSN was not carried by satellite distributors: e.g., in 2007, Comcast Sports Northwest, Comcast/Charter Sports Southeast, and Cox Sports Television were not broadcast on satellite distributors.

2.4 Data

We collect a wide variety of data to analyze the effects of vertical integration. We have three categories of data: (1) downstream prices, quantities, and characteristics of cable and satellite bundles, (2) channel viewership data, and (3) channel affiliate fees and advertising revenues. We briefly describe each in turn.

2.4.1 Downstream Prices, Quantities, and Characteristics

We combine data from multiple sources to construct downstream prices, quantities, and characteristics. Our foundational dataset is the Nielsen FOCUS database. For each cable system, it provides the set of channels offered (i.e., the channel "lineup"), the number of homes passed, the total number of subscribers (to any bundle of channels), the owner of the system, and the zip codes served. We use the years 2000 to 2010. We restrict our analysis to system-years in which the system faced no direct competition from another cable distributor.[13] We construct market shares by combining the number of subscribers reported by FOCUS (divided by the number of households in a market, obtained from 2000 and 2010 Census zip code data) with individual-level survey data from household survey firms Mediamark Research & Intelligence (MRI) and Simmons, using MRI data for 2000 to 2007, and Simmons for 2008 to 2010. Specifically, if a system-year had at least 40 survey respondents, we use the average of the market share from the FOCUS data and the cable market share among the survey respondents; otherwise we use only the FOCUS data. We eliminate any system-year for which we had less than 40 individual-level survey respondents in the MRI/Simmons data and the FOCUS subscriber data were not updated from the previous year. We use the remaining system-years to construct our markets.

[13] In our analysis, we focus only on markets in which there is a single cable and no other wireline (cable or telephone) distributor. We do so because when a system faces competition from another wireline distributor, we do not know the number of subscribers in the areas where the system faced competition relative to the areas where it did not. A second wireline distributor is present in 6% of all system-year observations. Our maintained assumption is that the omission of these markets does not affect the validity of our identifying assumptions or interpretation of results.

For our analysis, we define a market for each year to be a set of zip codes served by a single cable system and, by construction, both satellite distributors. For cable systems, we aggregate over bundles within a system, focusing on total system subscribers. Our demand model is therefore a distributor choice model, rather than a bundle choice model.[14] We construct satellite shares within each of our markets for DirecTV and Dish Network from the MRI/Simmons survey data.[15] We use historical channel offerings and prices for DirecTV and Dish Network collected via the Internet Archive (archive.org). Satellite bundles are assumed to vary across markets only in the set of RSNs carried. We assume that an RSN is carried by a satellite distributor in a given market if we observe that the satellite distributor carries that channel in any market, and the RSN is "relevant" in that market. We define an RSN to be relevant in a Nielson Designated Market Area (DMA)—and, hence, in all markets within that DMA—if, across all cable systems within that DMA at least 30 percent of the teams carried by the RSN are not "blacked out."[16] During our sample period, the average household subscribing to a cable distributor received 1.8 RSNs, and 80% of our markets have one or two relevant RSNs that are available.

We combine multiple sources of information on cable television prices. Systems regularly post prices on their websites and these websites are often saved in the Internet Archive. Following industry practice, we refer to the set of channels offered at a given (incremental) price as a tier of service and the combination of tiers chosen by households as the "bundle" that they buy.[17] We use the price of the expanded basic bundle, the most popular bundle chosen by households and the bundle which typically contains all of the channels in our analysis. In addition to price information on systems' websites, we utilize newspaper reports of price changes which provide price information at the local cable system level. Some newspapers report this information every time cable prices change (typically yearly), providing valuable information about the history of price changes for a single (often large) system or geographic family of systems owned by the same distributor. Finally, cable systems typically have "rate cards" describing their current tiers, channels, and prices which they use for marketing or to inform customers of changes in these offerings; they were used when able to be found online. We searched the Internet for all such information about cable prices and linked by hand the information obtained to FOCUS systems based on the distributor, principal geographic region served, and other regions served as reported in the newspaper or listed on the rate card. For system-years where we do not find a price from websites, rate sheets, or newspapers, we link to the TNS Bill Harvesting database. The TNS data are individual-level bills for cable

[14] The FOCUS data only report total subsscribers to the system, and our subscriber data are not rich enough to estimate bundle-specific quantities.

[15] We use a weighted average of state- and market-level satellite market shares, both calculated from the individual-level MRI/Simmons data. If we have between 1-19 market-level observations, we weight the market-level share by 0.75 (and the state-level share by 0.25). If we have 20 or more market-level observations, we weight market-level shares by 0.90. We dropped any constructed market whose total market share exceeded one or which, in the survey data, had a zero market share for one of the satellite distributors (which happens naturally due to sampling error).

[16] DMAs are mutually exclusive and exhaustive definitions of television markets created by Nielsen and used for the purchase of advertising time. Black-out rules are restrictions imposed by sports leagues that prevent broadcasts of a team's games in certain local markets. We use black-out information at the sport-team-zip-code level collected from MLB, NBA, and NHL websites in 2014 to determine whether a team is blacked-out in a given market.

[17] For example, the expanded basic bundle consists of the limited basic tier and the expanded basic tier.

service which report the company providing the service, the household's expenditure, and their zip code. For a given system-year, we use the mean expenditure for subscribers to that system if the data contain at least 5 bills.[18] These data also provide the level of any tax on cable and satellite television services; we use state satellite taxes, which vary over time, as an instrumental variable for price in our demand estimation.

Table A.1 reports the average price, market share, and number of cable, RSN, and total channels offered across markets and years in our estimation dataset. We use 11 years of data, comprising almost 7,000 market-years, with an average coverage of 39.7 million (over 35% of) U.S. households per year.[19] Average prices are quite similar across distributors, whether on an unweighted basis or weighted by the number of households in the market. The satellite distributors generally offer more channels on their Expanded Basic service than the local cable system, but a similar number of RSNs.

Finally, we derive MVPD margins for Comcast, DirecTV, and Dish from their 2007 10K reports; we use these as moments in our structural estimation.[20]

2.4.2 Viewership

We estimate demand using both bundle purchase and viewing data. We have two types of viewing data. One type provides information at the individual household level, and the other reports aggregate viewing decisions at the level of the DMA.

Individual household viewing data comes from the MRI and Simmons datasets described in the previous subsection. Our MRI data report the number of hours watched for each of the sampled households of 96 national channels from 2000 to 2007, while our Simmons data report the same information for 99 national channels between 2008 and 2010. Our aggregate ratings data come from Nielsen, which provides the percentage of households in a DMA watching a given program on a given channel at a given time. Reported is the average rating for each of between 63 and 100 channels, of which 18 to 29 are RSNs, depending on the year, in each of the 44 to 56 largest DMAs between 2000 and 2010.

Tables A.2 and A.3 report summary statistics for our viewing data. Table A.2 reports, for each of our sources of viewing data, the mean rating for each of the 38 (non-RSN) national channels

[18] We only use bills which clearly delineate video programming costs (i.e., that separate it out from other bundled services such as internet and phone), and use the average of a system's revenue (excluding pay-per-view or one-time charges) to construct prices.

[19] While we observe the complete population of channel lineups, incomplete reporting of subscriber information in the FOCUS dataset and the inability to collect cable prices in some markets prevents us from constructing the information we need in every U.S. cable market.

[20] We compute Comcast margins using video, advertising, and franchise fee revenues; programming expenses; and sales, general, and administrative (SG&A) expenses multiplied by both the video revenue share of total revenues (to proportionately allocate expenses across Comcast's other businesses) and the share of SG&A expenses that are subscriber acquisition and retention related (computed from DirecTV's reports). We compute DirecTV margins using total revenues; and programming, subscriber acquisition, upgrade, and retention expenses. We compute Dish margins using total revenues; subscriber acquisition costs; and the share of subscriber related expenses multiplied by the share of non-SG&A costs (programming and service expenses) that are programming related (computed from DirecTV's reports). The computed values are $\{.539, .396, .413\}$.

included in our econometric analysis.[21] For example, the average rating for the ABC Family Channel in the Nielsen data across the 747 DMA-years for which the information was recorded is 0.418 percentage points. This suggests that a household selected at random in one of these years and DMAs would be watching the ABC Family Channel with probability 0.418 percent. While small, this is above average for cable networks. Similarly, Table A.3 reports the average ratings for RSNs; for example, CSN Bay Area's average viewership is 0.41 percent. For RSN viewership, we have additional information—also reported in Table A.3—about the average RSN rating by type of distributor (i.e., cable or each satellite operator).

Our household-level data provide further details about average viewing of national channels which are summarized in the remaining columns of Table A.2. The last column reports the share of households on average across DMAs and years that report *any* viewing of that channel. As noted in Crawford and Yurukoglu (2012), this provides valuable information about whether a household has any interest in a channel that we will use to inform the estimated distribution of preferences for channels across households.

2.4.3 Average Affiliate Fees and Advertising Revenues

As described earlier, affiliate fees are the monthly per subscriber charges paid by distributors to content providers for the ability to distribute the channel. SNL Kagan maintains a database with aggregate information about individual cable television networks, both nationally-distributed networks like CNN and ESPN as well as RSNs like the family of Comcast and Fox networks. We obtain average affiliate fees paid by cable and satellite MVPDs to networks by dividing total affiliate fee revenues by total subscribers. Table A.2 reports average affiliate fees for each of the 38 national cable channels that we include in our analysis and Table A.3 reports the same information for each of the RSNs in our analysis. The average affiliate fee in our data for the national channels is \$0.30 per subscriber per month, while it is \$1.64 for our RSNs.

Per subscriber advertising rates are determined for each channel by dividing total advertising revenues by total subscribers (both provided by SNL Kagan).

3 Model

In this section, we present an industry model that predicts: (i) household viewership of channels; (ii) household demand for multichannel television services; (iii) prices and programming bundles that are offered by distributors; and (iv) negotiated distributor-channel specific affiliate fees. One key output from the specification and estimation of our model is the impact on viewership and demand of adding or removing channels from a bundle. This in turn informs the degree to which firms internalize the profits of integrated units when making strategic decisions, and the incentives of an integrated RSN to provide or withhold access to its content from rival distributors.

[21]The 38 national channels represent the top 36 channels by viewership which have ratings data for each year, plus two smaller channels with sports related content (ESPN Classic and Golf Channel).

3.1 Overview

We index consumer households by i, markets by m, and time periods by t. There are a set of "downstream" multichannel video programming distributors (MVPDs) $\mathcal{F}_t$ and "upstream" channels $\mathcal{C}_t$ active in each period t. The set of MVPDs active in a given market-period is denoted $\mathcal{F}_{mt}$. We will assume that each such MVPD $f \in \mathcal{F}_{mt}$ offers a single bundle of channels $\mathcal{B}_{fmt} \subseteq \mathcal{C}_t$ in market m and period t, where a household subscribing to this bundle pays a price p_{fmt} and has access to all channels $c \in \mathcal{B}_{fmt}$.[22] Since we assume that distributors offer only one bundle, f denotes both the distributor and the bundle it offers for a given market-period.

We assume that in each period t (a year in our empirical work), decisions are made according to the following timing: in **stage 1** channels and distributors bargain bilaterally to decide affiliate fees, and distributors set prices and make carriage decisions for each market in which they operate; in **stage 2** households choose which MVPD, if any, to subscribe to in their market; and in **stage 3** households view television channels.[23] We now provide details of each stage and further assumptions, proceeding in reverse order of timing.

3.2 Stage 3: Household Viewing

We assume that households solve a time allocation problem to determine viewership. In particular, household i in market m and period t subscribing to MVPD $f \in \mathcal{F}_{mt}$ allocates its time $\boldsymbol{w}_{ift} \equiv \{w_{ifct}\}_{c \in \mathcal{B}_{fmt} \cup \{0\}}$, where w_{ifct} is the time spent watching channel c (or devoted to non-television activities if $c = 0$), to solve:

$$\begin{aligned}
\max_{\boldsymbol{w}_{ift}} \; v_{ift}(\boldsymbol{w}_{ift}) \quad &= \quad \sum_{c \in \mathcal{B}_{fmt} \cup \{0\}} \frac{\gamma_{ict}}{1-\nu_c} (w_{ifct})^{1-\nu_c} \qquad (1) \\
s.t. \quad &: \quad w_{ifct} \geq 0 \; \forall \, c \, , \\
& \quad \sum_{c \in \mathcal{B}_{fmt} \cup \{0\}} w_{ifct} \leq T \, .
\end{aligned}$$

Parameters γ_{ict} and $\nu_c \in [0, 1)$ govern consumer tastes for each channel c, where γ_{ict} sets the level of marginal utility of household i from the first instant of watching the channel, and ν_c controls how fast this marginal utility decays with additional viewing. The parameter T represents the total time available to the household. We restrict ν_c to be equal for all non-sport channels and the outside-option, and equal for all sports channels (which include RSNs); i.e., $\nu_c = \nu^S$ if c is a

[22] In the previous section, we explained why the data only permit us to look at demand for the most popular (expanded basic) bundle offered by each distributor in each market. We do not model distributor within-market price discrimination (e.g., by offering multiple channel bundles or à la carte add-ons); see Crawford and Yurukoglu (2012) for further discussion. As modeled here, vertical integration does not affect how distributors are allowed to price, nor does it affect the ability of channels to price discriminate among distributors (who are charged a distributor-specific affiliate fee and cannot resell access to the channel; see also footnote 35).

[23] Stages 2 and 3 of our model describe a discrete-continuous choice model of consumer behavior over distributors and viewership (cf. Dubin and McFadden, 1984; Hanemann, 1984).

sports channel, and $\nu_c = \nu^{NS}$ otherwise.[24] We parameterize γ_{ict} as a function of channel-specific parameters $\boldsymbol{\rho}_c \equiv \{\rho_c^0, \rho_c^1\}$ as follows:

$$\gamma_{ict} = \begin{cases} \tilde{\gamma}_{ict} & \text{with probability } \rho_c^0, \text{ where } \tilde{\gamma}_{ict} \sim \text{Exponential}(\rho_c^1) \\ 0 & \text{with probability } 1-\rho_c^0 \end{cases} \qquad \forall\, c,t\ .$$

For RSNs, we scale $\tilde{\gamma}_{ict}$ by $\exp(\gamma^b b_{ict} + \gamma^d d_{ic})$, where $b_{ict} \in [0,1]$ represents the fraction of teams carried on RSN c that are "blacked-out" (i.e., unable to have games televised in household i's market), and d_{ic} is the average distance from household i to the stadiums of the teams shown on RSN c (measured in thousands of miles).[25] These terms allow for households to value an RSN differentially if the household cannot watch some of the carried sport teams, or if the household lives further away from the carried teams' stadiums.

3.3 Stage 2: Household Distributor Choice

Each period, household i considers characteristics of the bundle offered by each MVPD $f \in \mathcal{F}_{mt}$—including the utility from watching channels in the bundle—when determining which distributor, if any, to subscribe to. We specify household i's utility conditional on subscribing to f as:

$$u_{ifmt} = \beta^v v^*_{ifmt} + \boldsymbol{\beta}^x \boldsymbol{x}_{fmt} + \beta^{sat}_{if} + \alpha p_{fmt} + \xi_{fmt} + \varepsilon_{ifmt}\ , \tag{2}$$

where v^*_{ifmt}, referred to as a consumer's *viewership utility* for the bundle offered by f, is the optimized value from the time allocation problem in (1), $\boldsymbol{x}_{fmt}$ are firm-state and year dummy variables, p_{fmt} is the per month price (including any taxes), and ξ_{fmt} is a scalar unobservable demand shock for the bundle. Each consumer has a random preference for each satellite distributor, β^{sat}_{if}, that is drawn from an independent exponential distribution with parameter ρ^{sat}_f; we assume that $\beta^{sat}_{if} = 0$ if f is a cable distributor.[26] We assume that the utility of the outside option of no bundle is normalized to $u_{i0mt} = \varepsilon_{i0mt}$, that $\boldsymbol{\varepsilon}_{imt} \equiv \{\epsilon_{ifmt}\}_{\forall f}$ is distributed Type I extreme value,

[24] Allowing for this parameter to differ between sports and non-sports channels is motivated by the observation that sports channels receive higher affiliate fees than national channels for the same viewership ratings; we discuss this further in Section 4.1.2. Our viewership model is equivalent to the Cobb-Douglas model used in Crawford and Yurukoglu (2012) if $\nu_c \to 1$ for all c.

[25] RSNs may be carried by systems outside of a team's local area for at least two reasons. First, an RSN may broadcast games from different sport leagues with different black-out restrictions. For example, CSN Chicago is carried on systems in Indianapolis even though Chicago Bulls games that the RSN broadcasts are blacked-out (Indianapolis is Pacer's territory), as the RSN also broadcasts Chicago Cubs games (which are considered in-market for Indianapolis). The second reason is that RSNs also broadcast programming not subject to black-out restrictions, which include other sports (e.g., racing, boxing, poker) in addition to sports news and specialized programming. We focus only on black-out restrictions for MLB, NBA, and NHL teams. We ignore the NFL in our analysis since its games have only been aired by national channels since the 1960s (CBS, NBC, Fox, ESPN, and the NFL Network currently own its television rights).

[26] As we discuss in the next section, allowing for heterogeneity in preferences for satellite bundles assists our model in matching observed distributor price-cost margins. Allowing for random satellite preferences to be correlated did not significantly affect parameter estimates or our main counterfactual predictions.

and that each household chooses the bundle with the highest value of u_{ifmt}.[27]

The probability that household i chooses distributor f in market m is obtained by integrating over $\boldsymbol{\varepsilon}_{it}$ for each household:

$$s_{ifmt} = \frac{\exp(\beta^v v^*_{ifmt} + \boldsymbol{\beta}^x \boldsymbol{x}_{fmt} + \beta^{sat}_{if} + \alpha p_{fmt} + \xi_{fmt})}{1 + \sum_{g \in \mathcal{F}_{mt}} \exp(\beta^v v^*_{igmt} + \boldsymbol{\beta}^x \boldsymbol{x}_{gmt} + \beta^{sat}_{ig} + \alpha p_{gmt} + \xi_{gmt})} \ . \tag{3}$$

The total market share for distributor f (in market m at time t) is then $s_{fmt} \equiv \int s_{ifmt} dH_{mt}(i)$, where $H_{mt}(i)$ is the joint distribution of household random coefficients $(\boldsymbol{\gamma}, \boldsymbol{\beta})$ in the market, and the demand for distributor f is $D_{fmt} \equiv N_{mt} s_{fmt}$, where N_{mt} is the number of television households in the market.

3.4 Stage 1: Distributor Pricing, Carriage, and Affiliate Fee Bargaining

In Stage 1, all MVPDs and channels bargain over affiliate fees $\boldsymbol{\tau}_t \equiv \{\tau_{fct}\}_{\forall f,c}$, where τ_{fct} represents the period t fee that distributor f pays the owner of channel c for each of f's household subscribers. Simultaneously, each distributor chooses the prices and channel composition of its bundle in every market in which it operates.[28] That is, we assume that bargaining occurs simultaneously with the determination of distributor pricing and carriage decisions; we provide further discussion of this assumption in Section 3.4.3. We assume that affiliate fees, bundle prices, and bundle compositions are optimal with respect to one another in equilibrium.

We now discuss these optimality conditions in more detail, considering first distributors' pricing and carriage decisions (given the affiliate fee bargaining outcome), and then affiliate fee bargaining (given distributor pricing and carriage).

3.4.1 Stage 1a. Distributor Pricing and Carriage

Each period, every MVPD $f \in \mathcal{F}_t$ chooses prices and the channels offered in each of its bundles $\{p_{fmt}, \mathcal{B}_{fmt}\}_{\forall m: f \in \mathcal{F}_{mt}}$ to maximize its profits given negotiated affiliate fees $\boldsymbol{\tau}_t$. Profits for f across all markets are:

$$\Pi^M_{ft}(\{\mathcal{B}_{mt}\}_m, \{\boldsymbol{p}_{mt}\}_m, \boldsymbol{\tau}_t; \mu) = \sum_{m: f \in \mathcal{F}_{mt}} \Pi^M_{fmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu) \ ,$$

where:

$$\Pi^M_{fmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu) = D_{fmt} \times \left(p^{\text{pre-tax}}_{fmt} - mc_{fmt} \right) + \mu \times \Big(\sum_{g \in \mathcal{F}_{mt}} \sum_{c \in \mathcal{B}_{gmt}} O^M_{fct} \times D_{gmt} \times (\tau_{gct} + a_{ct}) \Big) \ , \tag{4}$$

[27] Our normalization allows for variation in the quality of the outside option (which includes local antenna reception for television signals) across markets and time due to our inclusion of firm-state and year dummy variables.

[28] A given cable distributor f often operates in many markets, and is choosing its price and set of channels to offer in each of these markets. Satellite distributors choose a single national price and channel bundle, with the only potential variation across DMAs being the set of RSNs that are carried.

(where we omit the arguments $(\mathcal{B}_{mt}, \boldsymbol{p}_{mt})$ from demand terms for notational simplicity, and, as in the rest of this section, $\mathcal{F}_{mt}$ also includes f). In expression (4), we denote by $\mathcal{B}_{mt} \equiv \{\mathcal{B}_{fmt}\}_{f \in \mathcal{F}_{mt}}$ and $\boldsymbol{p}_{mt} \equiv \{p_{fmt}\}_{f \in \mathcal{F}_{mt}}$ the set of channels and associated prices offered in market m, and by a_{ct} the expected per-subscriber advertising revenue obtained by channel c from bundles that carry c. Firm revenues are derived from pre-tax prices, $p_{fmt}^{\text{pre-tax}} \equiv p_{fmt}/(1 + \text{tax}_{fmt})$, which are a function of market-specific cable or satellite tax rates that are known and assumed to be determined exogenously. The term O_{fct}^{M} is a function of MVPD f's ownership share of channel c at time t; we refer to f and c as being integrated if $O_{fct}^{M} > 0$, with full integration equivalent to $O_{fct}^{M} = 1$.[29] The parameter μ, which we will estimate, captures the extent to which a downstream MVPD f internalizes upstream affiliate fees and advertising revenues from its integrated channels.

The first component of (4), an MVPD's profit function in a given market m, is standard: each bundle has a price and a marginal cost (mc_{fmt}) that determine its margin, and this is multipled by its demand. We assume that each MVPD f's marginal cost in market m can be decomposed into the sum of the per subscriber fees that f must pay to the various channels in its market-bundle, and bundle-specific non-channel-related marginal cost, denoted by κ_{fmt}: i.e., $mc_{fmt} \equiv \sum_{c \in \mathcal{B}_{fmt}} \tau_{fct} + \kappa_{fmt}$.[30] The second component of the profit function is non-standard, and represents the degree to which a vertically integrated downstream unit values the profits that accrue to its upstream (i.e., channel) units. These terms include per subscriber fees (τ_{gct}) and advertising revenues (a_{ct}) that accrue to integrated upstream channels from MVPD f's own viewers as well as from viewers of other distributors $g \neq f$, and are multiplied by the ownership share variables O_{fct}^{M} and parameter μ.[31] In the absence of any intra-firm frictions, μ would equal one, implying that the downstream unit of an integrated firm perfectly internalizes its (fully) integrated upstream units' profits, and its strategic decisions maximize total firm profit. The parameter μ could also be less than one, potentially representing divisionalization that could arise from ignorance, poor management, optimal compensation under informational frictions, or any other conflict between managers of different divisions within the same firm. By estimating μ we seek to uncover the extent to which such internalization actually occurs in our setting.

Cable Pricing and Carriage. We will leverage necessary conditions on the optimality of cable MVPDs' pricing and carriage decisions in our estimation. Differentiating (4) with respect to p_{fmt} (and dividing by market size) yields the following pricing first-order condition:

$$\frac{\partial \Pi_{fmt}^{M}}{\partial p_{fmt}} = \frac{s_{fmt}}{1 + \text{tax}_{fmt}} + \Big(p_{fmt}^{\text{pre-tax}} - mc_{fmt}\Big)\frac{\partial s_{fmt}}{\partial p_{fmt}} + \mu \times \Big(\sum_{g \in \mathcal{F}_{mt}} \sum_{c \in \mathcal{B}_{gmt}} O_{fct}^{M} \frac{\partial s_{gmt}}{\partial p_{fmt}}(\tau_{gct} + a_{ct})\Big) = 0\,. \quad (5)$$

[29] In Appendix C.1, we detail the construction of this and our other ownership variables (introduced later). For our analysis, we restrict $O_{fct}^{M} = 0$ if c is not an RSN.

[30] Non-channel related costs include technical service, labor, gasoline, and equipment costs that are incurred on a per subscriber basis.

[31] We omit portions of integrated channels' profits that are not affected by f's pricing and carriage decisions, as they do not affect the analysis. We also assume that channel c's per subscriber advertising revenues in market m do not vary across MVPDs, and that channel c's marginal costs per subscriber are zero.

With regard to carriage, a cable distributor's optimal decision for an RSN is indeterminate when no deal is reached between the distributor and that RSN: i.e., whether or not the distributor would carry the RSN on a subset of its systems in the event the RSN were available is irrelevant when the RSN is not available to the distributor at all. In our estimation, we will therefore make use of bundle optimality conditions for cable operators only for channels with which they have an agreement. Thus, we assume that the set of channels that are offered by each cable MVPD f in each market m satisfies:

$$\mathcal{B}_{fmt} = \arg \max_{\mathcal{B}_f \subseteq \mathcal{A}_{ft}} \Pi^M_{fmt}(\{\mathcal{B}_f, \mathcal{B}_{-f,mt}\}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu) \ , \tag{6}$$

where $\mathcal{A}_{ft} \subseteq \mathcal{C}_t$ is the set of channels available to MVPD f: i.e., the set of channels for which f has reached an agreement.

Satellite Pricing and Carriage. If instead distributor f is a satellite MVPD (DirecTV or Dish), we assume that the distributor sets a single national price and bundle. This national satellite price satisfies a similar optimality condition to (5) above. We assume that the bundle offered by a satellite MVPD in any given market may differ from the national bundle only in the set of RSN channels that are offered. In addition, we assume that satellite distributors adopt the strategy of carrying any channel for which they have negotiated a deal (intuitively, since any deal that is reached should make carriage profitable).[32]

3.4.2 Stage 1b: Bargaining over affiliate fees

Before describing how affiliate fees are determined, we specify the profits that each channel c contemplates when bargaining with MVPD f. We assume that if f and c are integrated (i.e., $O^M_{fct} > 0$), c's profits in market m are:

$$\begin{aligned}\Pi^C_{cmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu) = &\sum_{g \in \mathcal{F}_{mt} : c \in \mathcal{B}_{gmt}} D_{gmt} \times \Big(\tau_{gct} + a_{ct}\Big) \ \ldots \\ &+ \mu \sum_{g \in \mathcal{F}_{mt}} D_{gmt} \times \Big(O^C_{gct} \times (p^{\text{pre-tax}}_{gmt} - mc_{gmt}) + \sum_{d \in \mathcal{B}_{gmt} \setminus c} O^{CC}_{cdt} \times (\tau_{gdt} + a_{gdt}) \Big) \ .\end{aligned} \tag{7}$$

However, if f and c are not integrated, c's profits in m are:

$$\begin{aligned}\Pi^C_{cmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \boldsymbol{\tau}_t; \mu, \lambda_R) = &\sum_{g \in \mathcal{F}_{mt} : c \in \mathcal{B}_{gmt}} D_{gmt} \times \Big(\tau_{gct} + a_{ct}\Big) \ \ldots \\ &+ \mu \sum_{g \in \mathcal{F}_{mt}} D_{gmt} \times \Big(\lambda_R \times O^C_{gct} \times (p^{\text{pre-tax}}_{gmt} - mc_{gmt}) + \sum_{d \in \mathcal{B}_{gmt} \setminus c} O^{CC}_{cdt} \times (\tau_{gdt} + a_{gdt}) \Big) \ .\end{aligned} \tag{8}$$

In both (7) and (8), the first lines represent affiliate fees and advertising revenues that channel c obtains from each bundle on which the channel is available in market m, and the second lines

[32] For RSNs, we make this assumption only in the RSN's relevant markets.

$\Pi^C_{cmt} = \pi_{cmt} + \mu \times (\pi_{fmt} + \pi_{dmt})$ $\quad$ $\Pi^C_{cmt} = \pi_{cmt} + \mu \times ((\lambda_R \times \pi_{gmt}) + \pi_{dmt})$

(a) Internal Bargaining. (b) Bargaining with Rival MVPD.

Figure 2: Examples of Π^C_{cmt} when c bargains with MVPD f.

incorporate channel c's potential profits from its integrated downstream MVPDs (based on O^C_{gct}, a function of the ownership share of c held by MVPD g), as well as profits from other integrated channels d of channel c (which depend on O^{CC}_{cdt}, which is a function of the common ownership shares of channels c and d; see Appendix C.1 for further details).[33] These integrated profits are in each case multiplied by μ, the parameter capturing the extent of within-firm internalization across divisions.

The one difference between (7) and (8) is that in the latter expression, which is relevant when an integrated RSN c bargains with a non-integrated distributor f, any effects of the deal on downstream distributors integrated with c are multiplied by the parameter $\lambda_R \geq 0$. This parameter—our "rival foreclosure" parameter—captures the extent to which channel c considers the benefits of foreclosure (the denial of access to channel c) to its integrated downstream division g in its decision of whether to supply f. This benefit arises because non-supply lowers the quality of f's bundle, shifting demand to c's downstream division g. By including and estimating a lower bound on this parameter—rather than simply setting it equal to the theoretical value of 1—we aim to estimate the extent to which foreclosure concerns actually motivate integrated RSNs' supply decisions to non-integrated downstream rivals.

In Figure 2, we provide an illustration of how channel c's perceived profits when bargaining with MVPD f may change depending on whether or not it is integrated with f. In Figure 2a, the dashed square represents the fact that channel c is fully integrated with MVPD f (so that $O^M_{fct} = O^C_{fct} = 1$) and another channel d; in this case, when bargaining with its integrated distributor f, channel c will consider its own profits (denoted by π_{cmt}), consisting of affiliate fees and advertising revenues, as well as profits of f and its integrated channel d (denoted by π_f and π_d), weighted by μ: i.e., $\Pi^C_{cmt} = \pi_{cmt} + \mu \times (\pi_{fmt} + \pi_{dmt})$. In Figure 2b, channel c is instead integrated with another MVPD g (and still channel d); for example, f may be a satellite distributor while g is a cable distributor that owns channel c. In this case, channel c will consider its own profits π_{cmt} when bargaining with f (now a rival MVPD), as well as those of its integrated units π_{gmt} and π_{dmt}, weighted by $\mu \times \lambda_R$ and μ, respectively: i.e., $\Pi^C_{cmt} = \pi_{cmt} + \mu \times ((\lambda_R \times \pi_{gmt}) + \pi_{dmt})$.

The parameter λ_R (multiplied by μ) thus captures the internalization of an integrated downstream MVPD's profits when an integrated channel bargains with a non-integrated distributor. In

[33] In 2007, 4% of markets in our sample have two RSNs that are relevant and share a common owner; none have three or more relevant RSNs that share a common owner.

the case considered in Figure 2b, a higher value of λ_R increases channel c's desire to raise downstream profits of its fully integrated distributor g, and lowers c's gains from trade when bargaining with the non-integrated rival MVPD f. This may lead to an increased affiliate fee (τ_{fct}) for the rival distributor f. If the overall gains from trade are eliminated instead, it may lead to non-supply of channel c to f altogether.[34]

Finally, when c is only partially integrated with a distributor, the internalization parameter μ is multiplied by our ownership share variable in firms' perceived profits: e.g., in the case of external bargaining with distributor f when c is partially integrated with distributor g, c's perceived profits are $\Pi^C_{cmt} = \pi_{cmt} + \mu \times O^C_{gct} \times ((\lambda_R \times \pi_{gmt}) + \pi_{dmt})$. We assume the same internalization parameter μ is used by upstream units considering profits from either integrated downstream units or other integrated upstream units, and by downstream units considering profits of integrated upstream units.

Bargaining. We assume that, given channel c is carried on some of MVPD f's systems, the affiliate fee τ_{fct} between distributor f and channel c maximizes their respective bilateral Nash products *given the negotiated affiliate fees of all other pairs and the prices and bundles for all distributors.* In other words, affiliate fees $\boldsymbol{\tau}_t$ satisfy:

$$\tau_{fct}(\boldsymbol{\tau}_{-fc,t}, \mathcal{B}_t, \boldsymbol{p}_t) = \arg\max_{\tau_{fct}} \Bigg[\underbrace{\sum_{m \in \mathcal{M}_{fct}} [\Delta_{fc} \Pi^M_{fmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \{\tau_{fct}, \boldsymbol{\tau}_{-fc,t}\}; \mu)]}_{GFT^M_{fct}(\tau_{fct}, \cdot)} \Bigg]^{\zeta_{fct}} \times \Bigg[\underbrace{\sum_{m \in \mathcal{M}_{fct}} [\Delta_{fc} \Pi^C_{cmt}(\mathcal{B}_{mt}, \boldsymbol{p}_{mt}, \{\tau_{fct}, \boldsymbol{\tau}_{-fc,t}\}; \mu, \lambda_R)]}_{GFT^C_{fct}(\tau_{fct}, \cdot)} \Bigg]^{1-\zeta_{fct}} \quad \forall f, c \in \mathcal{A}_{ft} \ , \tag{9}$$

where $\mathcal{M}_{fct} \equiv \{m : c \in \mathcal{B}_{fmt}\}$ denotes the set of markets in which c is carried on f's bundle, $\zeta_{fct} \in [0, 1]$ represents a firm-channel-time specific Nash bargaining parameter, and:

$$[\Delta_{fc} \Pi^M_{fmt}(\mathcal{B}_{mt}, \cdot)] \equiv \left(\Pi^M_{fmt}(\mathcal{B}_{mt}, \cdot) - \Pi^M_{fmt}(\mathcal{B}_{mt} \setminus fc, \cdot) \right) ,$$
$$[\Delta_{fc} \Pi^C_{cmt}(\mathcal{B}_{mt}, \cdot)] \equiv \left(\Pi^C_{cmt}(\mathcal{B}_{mt}, \cdot) - \Pi^C_{cmt}(\mathcal{B}_{mt} \setminus fc, \cdot) \right) ,$$

[34] When it does not lead to non-supply, a positive value of our rival foreclosure parameter λ_R will lead to an increased input fee for non-integrated downstream rivals by reducing c's gains from trade. This "raising rivals' costs" effect differs from that in Salop and Scheffman (1983) and Krattenmaker and Salop (1986): in those papers, the supplier has all the bargaining power and is motivated by the effect that raising its input price has on downstream prices to consumers. With our simultaneous timing, channel c instead considers consumer prices as fixed when it bargains. Nonetheless, in equilibrium an increase in c's input fee can lead the non-integrated downstream distributor to raise its bundle price to consumers as we discuss further in Section 3.4.3. (Although in our main counterfactual specifications we assume that national satellite prices are held fixed, we also consider as an extension cases in which satellite bundle prices can adjust on a local level.)

where we denote by $\mathcal{B}_{mt} \setminus fc$ the set of all bundles in $\mathcal{B}_{mt}$ with channel c removed from bundle f. These last two terms represent the difference in either MVPD or channel profits in market m if f no longer carries channel c, and accounts for induced changes in household demand. We will refer to $GFT^M_{fct}(\tau_{fct}, \cdot)$ and $GFT^C_{fct}(\tau_{fct}, \cdot)$, which are the sums of these terms across all markets $\mathcal{M}_{fct}$, as the *gains from trade* for MVPD f and channel c coming to an agreement with affiliate fee τ_{fct}. We assume that each MVPD and channel negotiate a single affiliate fee that applies to all markets.[35]

In Appendix C.1, we show that when f and c share at most one common owner (which is the case for all MVPD-channel pairs considered in our analysis), $O^M_{fct} = O^C_{fct} \equiv O_{fct}$. When this holds, we can write the first-order condition of (9) for each channel c bargaining with MVPD f as:

$$(1 - \zeta_{fct}) \times GFT^M_{fct}(\tau_{fct}, \cdot) = \zeta_{fct} \times GFT^C_{fct}(\tau_{fct}, \cdot) \qquad \forall f, c \in \mathcal{A}_{ft} \; , \tag{10}$$

which states that the equilibrium negotiated input fee τ_{fct} between channel c and distributor f equalizes their (weighted) gains-from-trade.[36]

Alternatively, letting $\mu_{fct} \equiv \mu \times O_{fct}$, observe that $GFT^M_{fct}(\tau_{fct}, \cdot) = GFT^M_{fct}(0, \cdot) - (1 - \mu_{fct}) \sum_{m \in \mathcal{M}_{fct}} D_{fmt}\tau_{fct}$ and $GFT^C_{fct}(\tau_{fct}, \cdot) = GFT^C_{fct}(0, \cdot) + (1 - \mu_{fct}) \times \sum_{m \in \mathcal{M}_{fct}} D_{fmt}\tau_{fct}$, where we omit the arguments of D_{fmt} for convenience. Thus, we can rewrite (10) as:

$$[(1 - \mu_{fct})\tau_{fct}] \times \sum_{m \in \mathcal{M}_{fct}} D_{fmt} = (1 - \zeta_{fct}) \times GFT^M_{fct}(0, \cdot) - \zeta_{fct} \times GFT^C_{fct}(0, \cdot) \; , \tag{11}$$

which relates *the "effective" total payments made by distributor f to channel c*, given by the left hand side of (11), to a weighted sum of the gains from trade due to agreement at $\tau_{fct} = 0$, given by the right hand side. The effective total payments nets out the μ_{fct} fraction of f's affiliate fee payments to an integrated unit c that are not considered by f when making pricing, carriage, or bargaining decisions (see (4)). Intuitively, the more that f gains from the relationship, the higher the total (effective) payment that is made; the more that c gains from the relationship, the lower the total payment. If f and c's Nash bargaining parameters were equal, then $\zeta_{fct} = 1/2$ and the

[35] We rule out the possibility that RSNs are able to negotiate *market-specific* affiliate fees for each distributor (thereby engaging in a form of price discrimination across markets). Such richer pricing could reduce the degree of inefficient carriage decisions present in these markets, and thereby alter the welfare effects of vertical integration. To our knowledge, however, such contracts are not widely employed in this industry.

[36] When f and c are bargaining with one another and $\mu_{fct} \equiv \mu \times O_{fct} \neq 1$:

$$\frac{\partial GFT^M_{fct}(\cdot)}{\partial \tau_{fct}} = \sum_m \frac{\partial \Pi^M_{fmt}}{\partial \tau_{fct}} = -(1 - \mu_{fct}) \sum_{m \in \mathcal{M}_{fct}} D_{fmt} \; ,$$
$$\frac{\partial GFT^C_{fct}(\cdot)}{\partial \tau_{fct}} = \sum_m \frac{\partial \Pi^C_{cmt}}{\partial \tau_{fct}} = (1 - \mu_{fct}) \sum_{m \in \mathcal{M}_{fct}} D_{fmt} \; ;$$

thus $\partial GFT^M_{fct}/\partial \tau_{fct} = -\partial GFT^C_{fct}/\partial \tau_{fct}$ and (10) follows. The bargaining solution given by (9) is not defined if $\mu_{fct} = 1$; in this case, f and c perfectly internalize each other's profits when bargaining with one another, and the negotiated τ_{fct} is indeterminate. Finally, note that (10) implies that τ_{fct} is set to split the total gains-from-trade in proportion to their bargaining weights; e.g., $GFT^M_{fct}(\cdot) = \zeta_{fct}(GFT^M_{fct}(\cdot) + GFT^C_{fct}(\cdot))$.

total gain from trade would be split in half.

For estimation and our counterfactual simulations, we assume Nash bargaining parameters $\zeta_{fct} = \zeta^I$ or $\zeta_{fct} = \zeta^E$ depending on whether c and f are integrated ($O_{fct} > 0$) and bargain internally (I), or are non-integrated ($O_{fct} = 0$) and bargain externally (E). As we discuss in Section 3.4.3, the efficiency of a vertically integrated firm's pricing and carriage decisions depend on both ζ^I, μ, and O_{fct}.

Example: Non-integrated Bargaining. Consider the case in which MVPD f and channel c are both non-integrated entities that bargain with one another in period t. The negotiated affiliate fee τ_{fct} that satisfies the Nash bargaining solution given by (11) solves:

$$\sum_{m \in \mathcal{M}_{fct}} D_{fmt}\tau_{fct} = (1-\zeta_{fct}) \underbrace{\sum_{m \in \mathcal{M}_{fct}} \Big([\Delta_{fc} D_{fmt}](p^{\text{pre-tax}}_{fmt} - mc_{fmt\setminus fc}) \Big)}_{GFT^M_{fct}(0,\cdot)} - (\zeta_{fct}) \underbrace{\sum_{m \in \mathcal{M}_{fct}} \Big(D_{fmt} a_{ct} + \sum_{g \neq f : c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] \big(\tau_{gct} + a_{ct}\big) \Big)}_{GFT^C_{fct}(0,\cdot)}, \tag{12}$$

where $[\Delta_{fc} D_{gmt}] \equiv D_{gmt}(\mathcal{B}_{mt}, \cdot) - D_{gmt}(\mathcal{B}_{mt} \setminus fc, \cdot)$ denotes the change in firm g's demand in market m and time t if channel c was removed from firm f's bundle, and $mc_{fmt\setminus fc} \equiv \sum_{d \in \mathcal{B}_{fmt} \setminus c} \tau_{fdt} + \kappa_{fmt}$. As before, the left hand side of (12) represents the total payment made by distributor f to channel c. It is increasing in the additional profits (not including payments to c) that f receives from the additional subscribers induced by the carriage of channel c (given by the first line of the right hand side), decreasing in c's advertising revenues due to f's subscribers (represented by the terms $D_{fmt} a_{ct}$), and increasing in c's loss in profits from *other* distributors as a result of being carried on f (as $[\Delta_{fc} D_{gmt}] < 0$ for $g \neq f$). This last term, given by $[\Delta_{fc} D_{gmt}]\big(\tau_{gct} + a_{ct}\big)$ summed across other distributors g, can be interpreted as an opportunity cost borne by channel c from supplying distributor f, and relates the equilibrium affiliate fees that channel c receives from all distributors to each other (Chen, 2001).

3.4.3 Remarks on Bargaining and Vertical Integration

Our bargaining solution assumes that each distributor-channel pair agrees upon an affiliate fee that maximizes the Nash product of their gains from trade, given the agreements reached by all other pairs. It is motivated by the model put forth in Horn and Wolinsky (1988), and used by Crawford and Yurukoglu (2012) to model negotiations between MVPDs and channels. Other empirical papers that employ this concept, referred to as the "Nash-in-Nash" bargaining solution, include Draganska et al. (2010), Grennan (2013), Gowrisankaran et al. (2015), and Ho and Lee (2017).[37]

[37] While sometimes motivated as involving different bargaining agents for a firm in each negotiation, Collard-Wexler et al. (2017) provide a non-cooperative foundation for this particular bargaining solution based on a model of alternating offer bargaining in which a single agent bargains for each firm and can engage in multilateral deviations.

Our model also assumes that bargaining over affiliate fees happens simultaneously with distributors making carriage and pricing decisions. This assumption greatly simplifies the estimation and computation of our model. For example, we leverage the simultaneity of bargaining and pricing in deriving (11), as there is no anticipated change in p_{fmt} if τ_{fct} changes. Formally, one can think of separate divisions of the distributor engaging in different functions or actions: e.g., a central division bargains over affiliate fees, while local offices determine both pricing and carriage. Similarly, for a vertically integrated entity, separate divisions handle bargaining by the upstream unit and pricing by the downstream unit. Such timing assumptions have been used in Nocke and White (2007), Draganska et al. (2010), and Ho and Lee (2017).[38] An alternative timing assumption, more typical in the literature on vertical contracting, would be to assume that affiliate fees are first negotiated, and then distributor prices and bundles are chosen. This would alter firms' perceptions of the payoffs from off-equilibrium-path actions: e.g., when bargaining, firms would anticipate different bundle prices to be set immediately if off-equilibrium-path affiliate fees or disagreement were realized. While this alternative timing assumption would arguably be more realistic in our setting, and would lead to different parameter estimates, these parameter estimates would still be determined by trying to match the same patterns in the data as do our estimates; as such, the extent to which our timing assumption might affect the conclusions from our counterfactuals, and the direction of any such bias, is unclear.[39] In summary, we believe our approach to be a reasonable approximation with substantial computational benefits.[40]

Even with our simultaneous timing assumption, in equilibrium, all supply decisions must satisfy the conditions put forth in (5), (6) and (10): i.e., bundle prices and carriage are optimal with respect to equilibrium affiliate fees, and affiliate fees are negotiated while conditioning on equilibrium bundle prices and carriage. In the case in which a distributor-channel pair is not integrated, this can lead to double marginalization and inefficient carriage, so that their joint profit is not maximized, the extent of which depends on the external bargaining parameter ζ^E. When instead the distributor

Our analysis differs from Collard-Wexler et al. in that agents negotiate over linear fees, τ, rather than fixed fees. In Appendix B, we show how an extension of their model to our setting can be used to derive the necessary conditions for non-integrated firms that we employ in estimation.

[38]This timing is also implicit in the analysis described in Rogerson (2014). Note that one implication of this timing assumption, when combined with our approach to within-firm bargaining, is that we do not allow integrated firms to coordinate their downstream divisions' pricing and bundling decisions with an upstream channel's bargaining behavior with non-integrated distributors (e.g., a decision by the channel to refuse an offer from a non-integrated distributor).

[39]For example, a sequential timing assumption would have several effects: (i) it would reduce distributors' gains from trade (since they could lower their price upon disagreement) and raise channels' gains from trade (since the price reduction would take subscribers from rival distributors from whom the channel earns affiliate fees); (ii) it would create a benefit to the channel from agreeing to a lower affiliate fee (as this would reduce the distributor's downstream price); and (iii) it would create an additional incentive for an integrated RSN to raise the affiliate fee to a rival distributor (as the rival would increase its price). As we discuss further in footnote 60, the effect in (iii) is likely very small when the rival distributor is a national satellite channel. Effects (i) and (ii), on the other hand, would likely lead to different values of ζ^E, ζ^I and μ, but these estimates would still be fitting patterns in the data (such as the average affiliate fees of various RSNs and the differences in affiliate fees and pricing by distributors for integrated versus non-integrated channels).

[40]Certainly neither timing assumption is completely accurate: for example, the more common sequential timing may neglect the fact that carriage responses to affiliate fee changes may take time to implement, and that bundle prices may be set on an annual or semi-annual basis.

is integrated with the channel, the extent of inefficiency will depend on both the internalization parameter μ and the internal bargaining parameter ζ^I (and the extent of the ownership interest). The following example illustrates these points more concretely.

Example: Bargaining, Double Marginalization, and Vertical Integration To illustrate both how our model leads to double marginalization and the determinants of the efficiency gains brought by vertical integration, consider a simple setting with a single channel c and a single MVPD f that operates cable systems in markets $m \in \mathcal{M}_f \equiv \{m : f \in \mathcal{F}_m\}$ (where we ignore time subscripts t for this example). In each market m, downstream demand is $D_m(p)$ and per subscriber costs—excluding the affiliate fee for channel c—are mc_{fm} for the MVPD. Channel c earns advertising revenue a_c per subscriber. For simplicity, assume that each of f's cable systems is a local monopolist, that channel c shares no common owner with any other channel, and that carriage of channel c is optimal in all markets. Thus, we consider a classic vertical setting with bilateral monopoly.[41]

Consider first MVPD f's bundle pricing decision given an affiliate fee τ for channel c. Let $\mu_{fc} \equiv \mu \times O_{fc}$, and let $\phi_m(mc)$ be the monopoly price in market m for an independent monopolist distributor whose marginal cost is mc. Then, given τ, MVPD f will set bundle price

$$p_m = \phi_m(mc_{fm} + (1 - \mu_{fc})\tau - \mu_{fc}a_c) \tag{13}$$

in each market m. In effect, f prices using the effective marginal cost $mc_{fm} + (1 - \mu_{fc})\tau - \mu_{fc}a_c$ which counts only $(1 - \mu_{fc})$ of every dollar paid to c in affilliate fees (making the *effective* affilliate fee only $(1 - \mu_{fc})\tau$), and also counts as a benefit fraction μ_{fc} of every ad dollar channel c receives because of f's subscribers.

Next, given the bundle prices $\{p_m\}_{m \in \mathcal{M}_f}$, consider the bargaining between distributor f and channel c when f's bargaining parameter is ζ_{fc}. The gains from trade (at an affiliate fee of zero) for MVPD f and channel c, respectively, are

$$GFT_f^M(0, \cdot) = \left[\sum_{m \in \mathcal{M}_f} (p_m - mc_{fm})\Delta D_m(p_m)\right] + \mu_{fc}a_c \left[\sum_{m \in \mathcal{M}_f} D_m(p_m)\right],$$

and

$$GFT_c^C(0, \cdot) = a_c \left[\sum_{m \in \mathcal{M}_f} D_m(p_m)\right] + \mu_{fc} \left[\sum_{m \in \mathcal{M}_f} (p_m - mc_{fm})\Delta D_m(p_m)\right]$$

where $\Delta D_m(p_m)$ is the gain in f's subscribers in market m from reaching agreement with channel c, and c earns advertising revenues based on f's subscribers only if it reaches an agreement with f. Substituting these expressions into (11) and dividing by $\sum_{m \in \mathcal{M}_f} D_m(p_m)$, the negotiated effective

[41] Implicitly, we hold f's deals with all other channels fixed.

affiliate fee (when $\mu \neq 1$) is

$$(1-\mu_{fc})\tau = (1-\zeta_{fc}(1+\mu_{fc}))\left[\frac{\sum_{m\in\mathcal{M}_f}(p_m - mc_{fm})\Delta D_m(p_m)}{\sum_{m\in\mathcal{M}_f} D_m(p_m)}\right] + \left(\mu_{fc}(1-\zeta_{fc}) - \zeta_{fc}\right) a_c \ . \quad (14)$$

Double marginalization and efficiency in the integrated firm. Joint profit maximization for f and c requires that the bundle price in each market $m \in \mathcal{M}_f$ be

$$p_m^* = \phi(mc_{fm} - a_c), \quad (15)$$

which has the downstream bundle price set considering both downstream marginal costs mc_f and upstream ad revenues a_c. Examining (13), we see that joint profit maximization is achieved if $\mu_{fc} = 1$. When instead $\mu_{fc} \neq 1$—which can occur if the internalization parameter $\mu < 1$ or ownership $O_{fc} < 1$—the extent of inefficiency depends on *both* μ_{fc} and the bargaining parameter ζ_{fc}. To see this, note that (13) and (14) together imply that the price in each market m will satisfy the fixed point condition

$$p_m = \phi\left(mc_{fm} + [1-\zeta_{fc}(1+\mu_{fc})]\left[\frac{\sum_{m\in\mathcal{M}_f}(p_m - mc_{fm})\Delta D_m(p_m)}{\sum_{m\in\mathcal{M}_f} D_m(p_m)}\right] - \zeta_{fc}(1+\mu_{fc})a_c\right) \ . \quad (16)$$

Thus, joint profit maximization is achieved provided that $\zeta_{fc}(1+\mu_{fc}) = 1$. For example, joint profit maximization can occur in the case of non-integration ($O_{fc} = 0$) provided that $\zeta_{fc} = 1$, i.e., if f has all the bargaining power (in which case, $\tau = -a_c$). More generally, provided that the stability condition $\phi'(\cdot)(1-\zeta_{fc}) < 1$ is satisfied, the downstream bundle price is decreasing in $\zeta_{fc}(1+\mu_{fc})$, so when $\zeta_{fc}(1+\mu_{fc}) < 1$ we get double marginalization, where $p_m > p_m^*$. If joint profits in a market are concave in the bundle price, the loss in joint profit increases as $\zeta_{fc}(1+\mu_{fc})$ falls.

In the more complex environments that we study, where channel c also derives affiliate fee revenue from satellite distributors that compete with f, having $\zeta_{fc}(1+\mu_{fc}) = 1$ is no longer sufficient to achieve joint profit maximization: efficiency now requires that $\mu_{fc} = 1$ (which only occurs when $\mu = 1$ and $O_{fc} = 1$). The reason is that changes in f's bundle price now affect channel c's revenue from satellite distributor affiliate fees, and unlike channel c's per subscriber ad revenues a_c, these effects are market-specific, depending on the extent of diversion between cable and satellite in each market.[42] Letting the marginal reduction in channel c's satellite revenues from adding one cable subscriber in market m be b_{cm}, joint profit maximization now requires in each market m that

$$p_m^* = \phi_m(mc_{fm} + b_{cm} - a_c). \quad (17)$$

In contrast, a similar derivation to that above shows that when $\zeta_{fc}(1+\mu_{fc}) = 1$ the price in market

[42] The presence of other channels that share common owners with c can also generate market-specific effects.

m will instead be

$$p_m = \phi\left(mc_{fm} + (1-\mu_{fc})\left[\frac{\sum_{m\in\mathcal{M}_f}(b_{cm}-a_c)D_m(p_m)}{\sum_{m\in\mathcal{M}_f}D_m(p_m)}\right] + \mu_{fc}(b_{cm}-a_c)\right) \tag{18}$$

which generally equals the joint profit-maximizing price only if $\mu_{fc} = 1$.[43]

4 Estimation and Identification

In this section, we discuss the estimation of our model's parameters and how they are identified (given our modeling assumptions) from patterns in the data. We estimate all of our parameters jointly in a single step; however, for exposition, we discuss our estimation procedure in two steps:

1. We estimate $\boldsymbol{\theta} \equiv \{\boldsymbol{\theta}_1, \boldsymbol{\theta}_2, \boldsymbol{\theta}_3\}$, where:

   (a) $\boldsymbol{\theta}_1 \equiv \{\boldsymbol{\rho}, \boldsymbol{\nu}, \gamma^d, \gamma^b\}$, where $\boldsymbol{\rho} \equiv \{\rho_c^0, \rho_c^1\}_{\forall c}$ and $\boldsymbol{\nu} \equiv \{\nu^S, \nu^{NS}\}$, determines household viewership decisions by governing the distribution of γ_{ict}, how fast marginal utilities from viewership decay, and the viewership utility reductions due to black-outs and distance to teams' stadiums;

   (b) $\boldsymbol{\theta}_2 \equiv \{\beta^v, \boldsymbol{\beta}^x, \boldsymbol{\rho}^{sat}, \alpha\}$, where $\boldsymbol{\rho}^{sat} \equiv \{\rho^{sat}_{DirecTV}, \rho^{sat}_{Dish}\}$, determines household distributor choice;

   (c) $\boldsymbol{\theta}_3 \equiv \{\mu, \zeta^I, \zeta^E, \sigma^2_\omega\}$ are parameters that affect firm incentives when pricing, bargaining, and determining carriage of channels. Recall that the parameter μ governs the extent to which integrated channels and distributors internalize profits across upstream and downstream units. Finally, σ^2_ω is the variance of an error term that influences MVPDs' carriage decisions in a manner that we discuss below.

2. We estimate $\{\underline{\lambda}_R^{Phil}, \underline{\lambda}_R^{SD}\}$, representing separate lower bounds for our rival foreclosure parameter in each of the markets in which RSNs took advantage of the terrestrial loophole (i.e., Philadelphia and San Diego).

To capture the impact of program access rules, we assume that $\lambda_R = 0$ in non-loophole markets and estimate our first step parameters using only these markets. That is, we assume that the program access rules effectively require integrated firms to ignore any foreclosure incentives in dealing with non-integrated rivals.[44]

[43] Note that, consistent with our discussion above, (18) does yield a joint profit-maximizing price when b_{cm} is the same for all m, or when f is only active in a single market.

[44] We take this approach as a simple approximation to capture the effects of program access rules for both estimation and counterfactual simulation. In practice in markets subject to program access rules, an integrated channel could attempt to deny access to a rival distributor at the risk of triggering a binding arbitration process in which the negotiated affiliate fees with other distributors might be used to determine the arbitrated price. Explicitly modeling this process is beyond the scope of the current analysis, and we leverage the assumption that $\lambda_R = 0$ when PARs are enforced for tractability. Furthermore, we do not attempt to estimate a value of $\lambda_R \geq 0$ in markets where program access rules are in effect given the absence of variation in the data that we believe would allow us to identify such a parameter.

Our estimation procedure conditions on the ownership structures of firms that are observed in the data. We maintain the assumption that the integration status of a channel or distributor does not directly affect viewership utility or distributor demand, and is not correlated with either measurement error (e.g., in affiliate fees or markups) or market-level profit disturbances considered by firms when bargaining or making pricing or carriage decisions.[45] If these assumptions are violated, then this paper's predictions for the effects of vertical integration may be biased as these predictions would not account for unobservable factors that led to observed ownership structures. For example, if a channel and distributor are integrated for reasons outside our model (or in anticipation of positive profit shocks), then counterfactually demerging that pair may understate the benefits of integration. Likewise, if a channel and distributor are not integrated because of unmodeled costs of integration, counterfactually merging them would overstate the benefits of integration.

4.1 Estimation of Parameters $\boldsymbol{\theta}_1, \boldsymbol{\theta}_2, \boldsymbol{\theta}_3$

4.1.1 Moments used in Estimation

We estimate the model parameters via GMM, using the following moments.

Household Viewership. For every RSN and 38 national channels in each year, we use the difference between the following viewership moments observed in the data and predicted by the model:[46]

1. Summing across markets, the mean viewership for each channel-year;
2. Summing across markets, the number of households with zero viewership for each channel-year.[47]

Household Distributor Choice. For every year and market, we assume that the unobservable characteristic for each distributor's bundle is orthogonal to a vector of instruments: i.e., $E[\xi_{fmt}(\boldsymbol{\theta})\boldsymbol{Z}_{mt}] = 0$, where the expectation is taken across all markets, firms, and years. For $\boldsymbol{Z}_{mt}$, we include: firm-state and year dummy variables $\boldsymbol{x}_{fmt}$; the maximum fraction of teams carried by the relevant RSNs in the market that are not blacked-out (to instrument for bundle utility v^*_{fmt}); and the satellite tax within the market, interacted with an indicator for whether the bundle is offered by a cable or satellite distributor (to instrument for bundle prices p_{fmt}).[48] We recover

[45] This does not rule out the possibility that integrated channels may differ in quality from non-integrated channels (e.g., have different values of $\boldsymbol{\rho}_c$), as we estimate time varying channel taste parameters.

[46] To avoid re-solving the viewership problem for every household for every evaluation of a candidate parameter vector, we follow the importance sampling approach of Ackerberg (2009). See Appendix C.3 for further details.

[47] The MRI/Simmons data provides an estimate of the probability that a channel is never watched for national channels. We regress this probability on viewership, and use the estimated relationship to predict the probability that an RSN is never watched.

[48] The satellite tax changes that we use, by state year and percentage increase, are: CT 2003, 5%; FL 2002, 10%; KY 2006, 5%; MA 2009, 5%; NC 2003, 7%; OH 2003, 6%; and UT 2003, 5%. We discuss these instruments further in Section 5.2 and in footnote 65.

$\xi_{fmt}(\boldsymbol{\theta})$ using the standard Berry et al. (1995) inversion to match observed and predicted market shares (at each f, m, and t).

Distributor Bargaining, Pricing, and Carriage. First, for any $\boldsymbol{\theta}$, the vector of affiliate fees $\{\tau_{fct}\}$ and bundle-specific marginal costs $\{mc_{fmt}\}$ can be directly computed using the optimal pricing and bargaining conditions given by (5) and (10) (see Appendix C.2 for further details). We use these predicted values of $\{mc_{fmt}(\boldsymbol{\theta})\}$ and $\{\tau_{fct}(\boldsymbol{\theta})\}$ in constructing the next set of moments which we form using only 2007 data and values:

1. **Average affiliate fees**: For each RSN active in 2007 and four national channels (ABC Family, ESPN, TNT, and USA), we minimize the difference between the model's predicted average affiliate fees across MVPDs and observed average affiliate fees: $E_f[\tau_{fct}(\boldsymbol{\theta})] - \tau^o_{ct}$ (where variables with an o superscript denote values of those objects that are observed in the data). We weight estimated affiliate fees by national MVPD market shares conditional on observed carriage of the channel to approximate expectations across MVPDs.

   Deviations in these and the next set of moments for implied markups reflect both measurement error in the data and sampling error, as our predictions are computed using a subset of U.S. markets.

2. **Implied markups**: For each distributor $f \in \{Comcast, DirecTV, Dish\}$, we minimize the difference between the model's predicted MVPD price-cost margin and those observed in the data: $E_m[(p^o_{fmt} - mc_{fmt}(\boldsymbol{\theta}))/p^o_{fmt}] - markup^o_{ft}$.

3. **RSN Carriage**: Equation (6) implies that every cable distributor f chooses the optimal set of channels (from among those with which it has agreements) to include in each market m's bundle. We assume that distributor f's true per household profits (not per subscriber) in market m are given by $\tilde{\pi}^M_{fmt}(\cdot)$, where:

   $$\tilde{\pi}^M_{fmt}(\mathcal{B}_{mt}, \cdot) \equiv [\pi^M_{fmt}(\mathcal{B}_{mt}, \cdot) - \omega_{fmt}(\mathcal{B}_{fmt})] , \tag{19}$$

   and $\pi^M_{fmt}(\mathcal{B}_{mt}, \cdot)$ represents our (the econometrician's) estimate of a firm's per household profits. The term $\omega_{fmt}(\mathcal{B}_{fmt})$ represents a mean-zero i.i.d. bundle-distributor-market-time specific disturbance; we assume that $\omega_{fmt}(\cdot) \sim N(0, \sigma^2_\omega)$.[49]

   If channel c has negotiated an agreement with some firm f: (i.e., f carries c on its bundles in some non-empty set of markets), then firm f's optimal carriage decision given by (6) implies

[49] We interpret $\omega_{fmt}(\cdot)$ as the difference between our estimated profits and those used by a local system operator when determining carriage decisions; we assume that these disturbances are not accounted for by a distributor when pricing or bargaining with channels.

Table 1: Regression of RSN Carriage on Integration Status, Distance, and Blackout Percentage

	(1)	(2)	(3)	(4)
VI Ownership Share	0.404***	0.435***	0.293***	0.171**
	(0.0674)	(0.0837)	(0.110)	(0.0852)
% Teams not Blacked Out	0.412***	0.399***	0.429***	0.477***
	(0.0494)	(0.0586)	(0.109)	(0.107)
Avg Distance to RSN's Stadiums	-0.559***	-0.630***	-0.838***	-0.795***
(10^3 mi)	(0.100)	(0.117)	(0.238)	(0.284)
Years	2000-10	2007	2007	2007
Systems	All Systems	All Systems	Has P Q	Has P Q
Has Deal	No	No	No	Yes
Observations	154,121	12,246	1,132	1,052
R-squared	0.615	0.616	0.670	0.639

Notes: Linear probability regression where the dependent variable is whether a cable system carries an RSN in a relevant market in 2007. Specifications differ by sample used, where "Has P Q" restricts attention to systems for which price and quantity data is available, and "Has Deal" restricts attention to system-RSN pairs where the MVPD has a deal with the RSN (i.e., carries the RSN on at least one other system). All specifications use DMA, RSN and (when appropriate) year fixed effects. Inclusion of system demographic controls (race, population density, average income, household ownership) did not appreciably change point estimates. *** p<0.01, ** p<0.05, * p<0.1. Standards errors are reported in parenthesis, and are clustered by DMA.

that:

$$\begin{aligned}\Big([\Delta_{fc}\pi^M_{fmt}(\mathcal{B}_{mt}\cup fc,\cdot)] - [\Delta_{fc}\omega_{fmt}(\mathcal{B}_{fmt}\cup fc,\cdot)]\Big) &\geq 0 \qquad \forall m : c\in\mathcal{B}_{fmt}\ ,\\ \Big([\Delta_{fc}\pi^M_{fmt}(\mathcal{B}_{mt}\cup fc,\cdot)] - [\Delta_{fc}\omega_{fmt}(\mathcal{B}_{fmt}\cup fc,\cdot)]\Big) &\leq 0 \qquad \forall m : c\notin\mathcal{B}_{fmt}\ ,\end{aligned} \tag{20}$$

where $[\Delta_{fc}\pi^M_{fmt}(\mathcal{B}_{mt},\cdot)] \equiv \pi^M_{fmt}(\mathcal{B}_{mt},\cdot) - \pi^M_{fmt}(\mathcal{B}_{mt}\setminus fc,\cdot)$, $[\Delta_{fc}\omega_{fmt}(\mathcal{B}_{fmt})] \equiv \omega_{fmt}(\mathcal{B}_{fmt}) - \omega_{fmt}(\mathcal{B}_{fmt}\setminus fc)$, and $\mathcal{B}_{mt}\cup fc$ denotes the set of all bundles $\mathcal{B}_{mt}$ where c is added to bundle f.[50] That is, these inequalities imply that in any market in which c is carried by f, f obtains higher profits from carrying than by dropping c (holding fixed prices and carriage decisions of other firms); similarly, in any market where c is not carried, f obtains higher profits from not carrying than by carrying c.

Given our assumptions on the distribution of $\omega_{fmt}(\cdot)$, it follows that:

$$\Pr(c\in\mathcal{B}_{fmt}) = \Phi([\Delta_{fc}\pi^M_{fmt}(\mathcal{B}_{mt}\cup fc,\cdot)]/(2\sigma_\omega))\ , \tag{21}$$

where Φ is the standard normal cumulative distribution function.

We construct several moments based on the model's predicted carriage probabilities. First, we construct moments based on indirect inference (cf. Gouriéroux and Monfort (1996)) that match the predicted to observed relationship between carriage of a relevant RSN by a system and (i) the ownership share of the RSN by the system's MVPD, (ii) the distance of the system to the RSN's teams' stadiums, and (iii) the fraction of teams on the RSN that are not

[50] In cases where $c\in\mathcal{B}_{fmt}$, this definition implies that $\mathcal{B}_{mt}\cup fc = \mathcal{B}_{mt}$.

blacked-out. Table 1 presents the results of a linear probability regression predicting whether a cable system carries a relevant RSN in our data. We find that carriage of an RSN by a cable system is increasing with the share of the RSN owned by the system's MVPD, and decreasing in the distance between the system and the RSN's teams' stadiums and in the fraction of teams that are blacked-out. We perform the same regression using the predicted carriage probabilities from our model, and match the estimated coefficients for vertical integration, distance, and the fraction of teams not blacked-out from this regression to the coefficients in specification (4) in Table 1.[51]

Second, we calculate the probability that an RSN is carried by a cable distributor in a relevant market, and match the probability that is observed in the data to that predicted by our model via (21).[52] Third, we set $\partial\mathcal{L}_{carriage}/\partial\sigma_\omega = 0$, where $\mathcal{L}_{carriage}$ is the predicted log-likelihood of the observed market-level RSN carriage decisions by cable MVPDs, given by:

$$\mathcal{L}_{carriage} = \sum_{c\in\mathcal{C}_t^R} \sum_{fm:c\in\mathcal{A}_{ft}} \Big(1_{\{c\in\mathcal{B}_{fmt}\}} \times \log\Pr(c\in\mathcal{B}_{fmt}) + 1_{\{c\notin\mathcal{B}_{fmt}\}} \times \log\Pr(c\notin\mathcal{B}_{fmt})\Big),$$

where $\mathcal{C}_t^R$ denotes the set of RSNs, and $\mathcal{A}_{ft}$ are the set of channels available to MVPD f.

4.1.2 Identification

We now provide a discussion of variation in the data that help identify the parameters of our model (given the assumptions and moment restrictions that we employ).

Viewership and Distributor Choice Parameters ($\boldsymbol{\theta}_1, \boldsymbol{\theta}_2$). We believe that our estimate of $\boldsymbol{\rho}$, the parameters that govern the distribution of channel tastes, is determined primarily by viewing behavior: i.e., channels watched by a larger fraction of households will tend to have higher values of ρ_c^0 (the probability that a channel delivers positive utility), and those that conditional upon being watched are watched more often will tend to have higher values of ρ_c^1 (the mean of the taste distribution). Since we do not possess ratings for RSNs at the market level, we believe black-out and distance parameters (γ^b and γ^d) are determined from other sources; we defer discussion of these parameters until the end of this subsection.

We believe that variation in bundle market shares as observed bundle characteristics and prices change is the primary source of information about parameters governing household bundle choice (α, $\boldsymbol{\beta}^x$ and $\boldsymbol{\beta}^v$). Table A.1 summarizes the variation in prices and channel carriage across markets. State satellite taxes are used as an instrument for price, and the fraction of blacked-out teams on RSNs in each relevant market is used as an instrument for viewership utility (as firms may respond

[51] We focus on the "Has Deal" specification as our model does not predict the probability of carriage for a system if the MVPD and channel do not have a deal.

[52] E.g., if there are only two RSNs A and B, and A is carried on cable in 30/40 of A's relevant markets, and B is carried on cable in 25/60 of B's relevant markets, the probability than an RSN is carried by a cable distributor in a relevant market is 0.55.

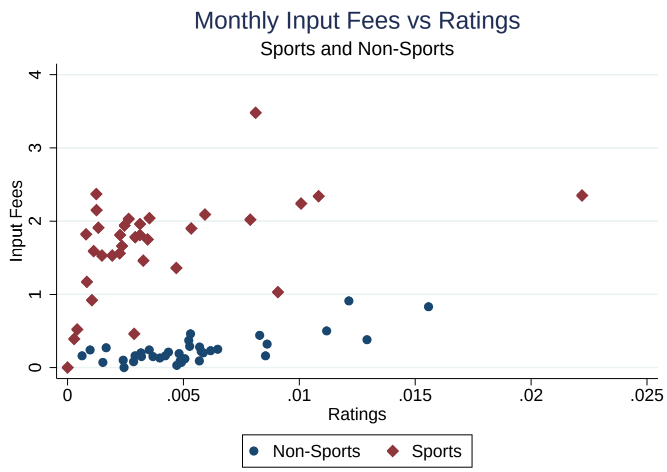


Figure 3: Negotiated monthly affiliate fees and viewership ratings.

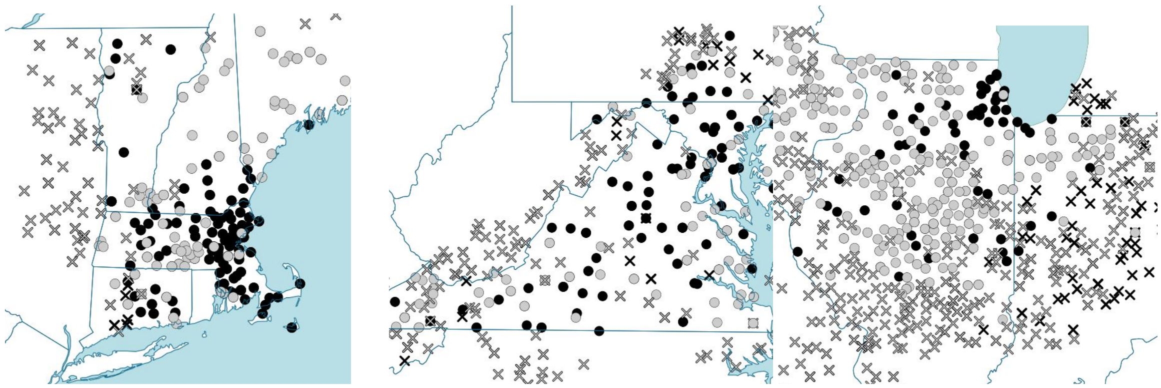
to local demand shocks when determining carriage). We believe that observed cable and satellite pricing margins provide the main source of identification for satellite preference heterogeneity ($\boldsymbol{\rho}^{sat}$).[53]

We supplement bundle market share variation with observed average affiliate fees for each channel. Our model predicts that a channel obtains higher affiliate fees if its presence has a greater impact on households' viewership utility when determining bundle choice (see (2)), as this implies that the channel generates larger gains from trade with distributors. Thus, observed affiliate fees provide information regarding the distribution of channel tastes and their scaling into viewership utility. In particular, we believe that the observed relationship between affiliate fees and ratings is the primary source of information for our "decay" parameters (ν_c^S for sports channels and ν_c^{NS} for non-sports channels). Our choice to allow different values of decay parameters for sports and non-sports channels is motivated by the data, illustrated in Figure 3. Sports channels have consistently higher negotiated affiliate fees than non-sports channels with similar ratings; our model is able to match this pattern by attributing a higher initial utility γ_{ic} and a higher decay rate ν^S to a sports channel that has the same ratings as a non-sports channel.[54]

Bargaining, Pricing, and Carriage Parameters ($\boldsymbol{\theta}_3$). The Nash bargaining parameters $\{\zeta^E, \zeta^I\}$ relate negotiated affiliate fees to distributor and channel gains from trade. If the external Nash bargaining parameter $\zeta^E = 0$ (so that distributors obtain no surplus when negotiating with a non-integrated channel), the bargaining first-order conditions given by (11) imply that affiliate fees between any distributor and non-integrated channel would be determined solely by the

[53]Under a standard logit demand system without preference heterogeneity, there is a strict relationship between product market shares and price elasticities; in these models, allowing for product-level preference heterogeneity can assist in rationalizing larger observed markups by reducing implied price elasticities for given market shares.

[54]For computational reasons, during estimation we restrict ν^S to lie on a discrete grid while allowing all other parameters to vary freely; see Appendix C.3 for further details and robustness tests. See also the discussion in the appendix of Crawford and Yurukoglu (2012) which examines a variant of this model using Monte Carlo simulation.



(a) CSN New England (b) CSN Mid-Atlantic (c) CSN Chicago

Figure 4: Carriage by Comcast and non-integrated cable MVPDs of three Comcast-integrated RSNs across cable systems in 2007. Dots represent carriage by a system, X's represent no carriage. Black markers represent Comcast systems, grey markers represent non-Comcast cable systems.

distributor's gains from trade; fees would not be affected by advertising revenues or factors entering solely the channel's gains from trade. Thus, controlling for viewership, we believe that the extent to which average affiliate fees vary with advertising revenues for non-integrated channels provides information about the value of ζ^E.[55]

Next, although the internalization parameter μ enters into the computation of several moments (including any moment based on affiliate fees or marginal costs), we expect that its value is primarily determined by our RSN Carriage moments and the higher observed carriage rates between integrated distributors and channels (captured in the regressions in Table 1): as μ increases (holding all other parameters fixed), our model predicts that distributors have a greater incentive to carry an integrated channel for a fixed contribution of the channel to downstream profits. We believe that black-out and distance parameters, γ^b, γ^d, are determined in a similar fashion to μ. In addition, given μ and ζ^E, the level of average affiliate fees for integrated channels should then provide information about the value of the internal Nash bargaining parameter ζ^I. While the internally negotiated affiliate fee between an integrated distributor and channel is not directly observed, it can be recovered from the channel's average affiliate fees across all distributors (which is observed) and its average affiliate fee from non-integrated distributors only (which is a function of μ, ζ^E and the channel's gains from trade from those distributors).

An example of the variation in the data that we leverage is illustrated in Figure 4, which presents the integrated and non-integrated carriage of a Comcast integrated RSN in three different regions of the U.S. In these regions, cable systems in markets close to the RSN's teams' stadiums almost always carry the RSN; systems far away most often do not. However, in markets located a moderate distance away, these RSNs are much more likely to be carried on Comcast-owned systems than on non-integrated systems.[56] These maps also indicate that non-carriage is much more likely in areas

[55]The relationship between average affiliate fees for non-integrated channels and their estimated joint gains from trade with distributors also provides information about the value of ζ^E.

[56]For example, in Figure 4a, all Comcast systems in northern Vermont carry CSN New England (black dots)

where the teams on the RSN are blacked-out (as in New York for CSN New England, Pennsylvania for CSN Mid-Atlantic, and Michigan for CSN Chicago).

Finally, the variance of carriage disturbances σ_ω^2 affect only the value of our carriage moments. As this variance increases (holding all other parameters fixed), the predicted carriage probability for any channel approaches 1/2 as predicted carriage decisions become based purely on noise. We thus believe that lower values of σ_ω^2 indicate that our model's predicted changes in distributors' profits from carriage can be used to predict observed carriage decisions.[57]

4.2 Estimation of Lower Bounds for Rival Foreclosure Parameter

To recover lower bounds for our rival foreclosure parameter λ_R, we will use information provided by markets in which distributors are able to exclude competitors from carrying an integrated RSN channel—i.e., terrestrial loophole markets. The markets we focus on are Philadelphia and San Diego, the channels in question CSN Philadelphia (owned by Comcast) and 4SD (owned by Cox), and the competitors excluded from carriage are satellite distributors DirecTV and Dish.

Observe that because these two markets both had total exclusion of satellite distributors, we will only be able to estimate lower bounds on λ_R, which we will denote by $\underline{\lambda}_R^{Phil}$ and $\underline{\lambda}_R^{SD}$ for each market. Intuitively, for each market, the lower bound will be the lowest level of λ_R at which there are no mutual gains from trade between the RSN and either satellite distributor (i.e., the value of λ_R at which the gains from exclusion exceed the gains from carriage). In general, however, whether there are gains from trade between an RSN and a satellite distributor depends on the satellite firm's beliefs about whether, if it is supplied, the other satellite firm will also be supplied. In Appendix B we show that a *necessary* condition for non-supply, *regardless of the satellite firm's beliefs*, is that the joint profit of the RSN c and the two satellite firms g and g' is reduced when both satellite firms have access to the RSN, which can be stated as:

$$\sum_{m \in \mathcal{M}_c} \Bigg[[\Delta_{gc,g'c} \Pi^M_{gmt}(\{\mathcal{B}^o_{mt} \cup \{gc, g'c\}\}, \boldsymbol{p}^o_{mt}, \tilde{\boldsymbol{\tau}}; \hat{\mu})] + [\Delta_{gc,g'c} \Pi^M_{g'mt}(\{\mathcal{B}^o_{mt} \cup \{gc, g'c\}\}, \boldsymbol{p}^o_{mt}, \tilde{\boldsymbol{\tau}}; \hat{\mu})] \ldots$$
$$+ [\Delta_{gc,g'c} \Pi^C_{cmt}(\{\mathcal{B}^o_{mt} \cup \{gc, g'c\}\}, \boldsymbol{p}^o_{mt}, \tilde{\boldsymbol{\tau}}; \hat{\mu}, \lambda_R)] \Bigg] \le 0 \,, \qquad (22)$$

where $\mathcal{M}_c$ represents the set of c's relevant markets. The left-hand side of (22), which we refer to as the "three-party surplus," represents g, g', and c's joint gains from trade from both g and g' being supplied with channel c and carrying the channel in all of c's relevant markets, and $\tilde{\boldsymbol{\tau}}$ equals the predicted values of affiliate fees $\hat{\boldsymbol{\tau}}(\cdot)$ except that $\tilde{\tau}_{gct} = \tilde{\tau}_{g'ct} = 0$.[58]

whereas most non-Comcast systems (grey dots for systems that carry the RSN, and grey X's for those that do not) do not carry CSN New England. In Figures 4b and 4c, non-carriage by non-Comcast systems occurs much closer to the RSN's teams' stadiums than for Comcast systems: there is a higher ratio of grey X's to grey dots near Washington DC and Chicago than of black X's (non-carriage by Comcast systems) to black dots.

[57]Note that our intuition behind the determination of μ relies on carriage rate *differences* between non-integrated and integrated firms, whereas σ_ω^2 relies on carriage rate *levels* for either non-integrated or integrated firms.

[58]Specifically, we show that in an alternating offer bargaining game of the form studied by Collard-Wexler et al.

For each of the loophole-market cable-integrated RSNs that do not contract with the satellite distributors (CSN Philadelphia and 4SD), we estimate the corresponding lower bound that holds for any beliefs held by a satellite firm about whether the RSN will also be supplied to the rival satellite firm by finding the lowest value of λ_R that makes (22) hold.[59]

Incentives for Exclusion. It is instructive at this point to discuss the competing forces that would induce a cable provider to withhold its integrated RSN from a satellite provider. This is equivalent to understanding why the gains created when satellite distributors are supplied with the RSN may be offset by the losses incurred by the integrated cable provider.

The primary gains-from-trade contemplated when a satellite distributor g is supplied with the RSN are through potential market expansion effects from carriage: i.e., if consumers who previously did not subscribe to any MVPD now would if satellite were to carry the RSN. Each household that substitutes from the outside good to g would generate additional industry profit equal to the level of g's margins plus any additional advertising revenues generated by those households watching the RSN.

The primary losses generated by supplying g with the RSN would be incurred by the RSN's integrated cable distributor if households substituted away from the integrated cable provider to g. Although these consumers would generate profit for g, insofar as cable margins are higher than those of satellite providers (by 10+ percentage points in our data), any household that switched from cable to satellite as a result of supplying satellite with the RSN would reduce industry profit by this difference in margins.[60]

Consequently, factors that make exclusion of satellite by an integrated cable owner (for $\lambda_R > 0$) more likely include: (i) a smaller share of consumers that are not subscribers to any MVPD and lower advertising rates (thereby reducing the potential gains generated by market expansion); (ii) a larger cable "footprint" (market share) in the RSN's relevant market area; (iii) closer substitutability between satellite and cable distribution; and (iv) a larger differential between cable and satellite margins (all of which would exacerbate the losses from business stealing by satellite from cable). For all such factors, lower values of λ_R (closer to 0) cause any losses incurred by the RSN's integrated owner to be internalized less by the RSN when bargaining with g, reducing the likelihood of exclusion occurring.

(2017), if the three-party-surplus is positive, then RSN c has a deviating pair of offers $\{\tilde{\tau}_{gc}, \tilde{\tau}_{g'c}\}$ to both satellite distributors that both will accept regardless of their beliefs over whether, if they are supplied, their rival will also be supplied, and that will increase c's profits. See Appendix B for a formal derivation and discussion of the idea behind this result.

[59] An alternative would be to assume that when approached by the RSN to negotiate supply, a satellite firm holds the belief that the rival satellite firm will not be supplied. The approach we employ instead provides a lower bound for λ_R that holds for any beliefs.

[60] Our timing assumptions rule out the possibility that an integrated channel contemplates the possibility of raising the rival g's price through "raising rivals' cost" effects (cf. Salop and Scheffman, 1983). However, for a single cable-integrated RSN whose rivals are satellite distributors that set a single national price, this effect would be small as an increase in the RSN's affiliate fee would only affect satellite distributors' costs in a small portion of their markets.

Table 2: Estimates of Key Parameters

	Parameter	Description	Estimate	SE
Viewership	ν^{NS}	Viewership Decay, Non-sports	0.59	0.00
Parameters	ν^{S}	Viewership Decay, Sports	0.95	-
$\boldsymbol{\theta}_1$	γ^{b}	Fraction of Teams Blacked-out	-0.58	0.31
	γ^{d} (10^3mi)	Distance	-0.93	0.27
Bundle Choice	α	Bundle Price	-1.00	0.44
Parameters	β^{v}	Bundle Viewership Utility	0.14	0.07
$\boldsymbol{\theta}_2$	$\rho^{sat}_{DirecTV}(10^2)$	DirecTV Exponential Parameter	0.42	0.23
	$\rho^{sat}_{Dish}(10^2)$	Dish Exponential Parameter	0.49	0.27
Pricing, Bargaining,	σ^2_{ω}	Variance of Carriage Shocks	0.00	0.00
Carriage and	ζ^{E}	Bargaining, External	0.28	0.03
Foreclosure Parameters	ζ^{I}	Bargaining, Internal	0.37	0.06
$\boldsymbol{\theta}_3, \underline{\lambda}_R$	μ	Internalization	0.79	0.09
	$\mu \times \underline{\lambda}^{Phil}_{R}$	Internalization & Rival Foreclosure, Philadelphia	1.11	0.14
	$\mu \times \underline{\lambda}^{SD}_{R}$	Internalization & Rival Foreclosure, San Diego	0.94	0.11

Notes: Selected key parameters from the first and second step estimation of the full model, where parameter ν^S is estimated separately via a grid search (see Appendix C.3). Additional viewership parameters contained in $\boldsymbol{\theta}_1$ are reported in Appendix Table A.4; state-firm and year fixed effects in $\boldsymbol{\theta}_2$ are not reported. Asymptotic GMM standard errors are computed using numerical derivatives and 1500 bootstrap draws of markets and simulated households to estimate the variance-covariance matrix of the moments. Estimates and standard errors for $\mu \times \underline{\lambda}^{Phil}_{R}$ and $\mu \times \underline{\lambda}^{SD}_{R}$ are for the lower bound of these parameters.

5 Results and Parameter Estimates

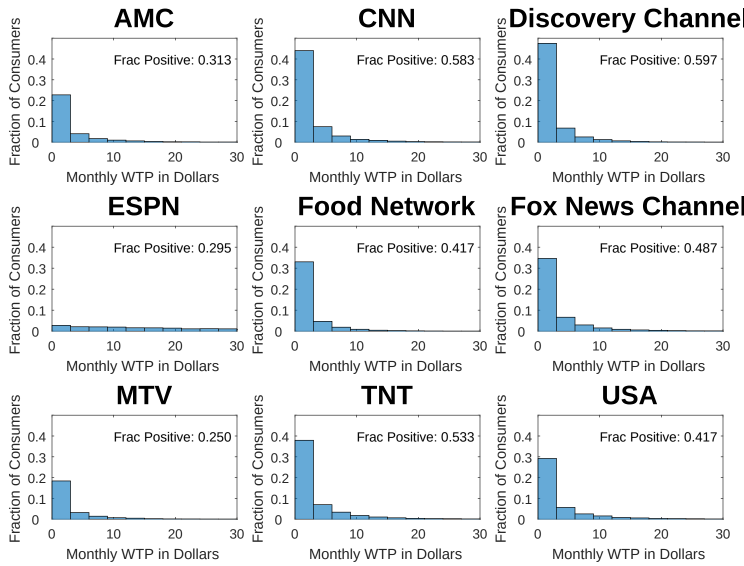
Estimates of selected key parameters of our model are reported in Table 2. We discuss our estimates primarily through how they influence predicted moments relating to consumer viewership and subscription patterns, firm pricing and carriage decisions, and negotiated agreements.

5.1 Viewership Parameters

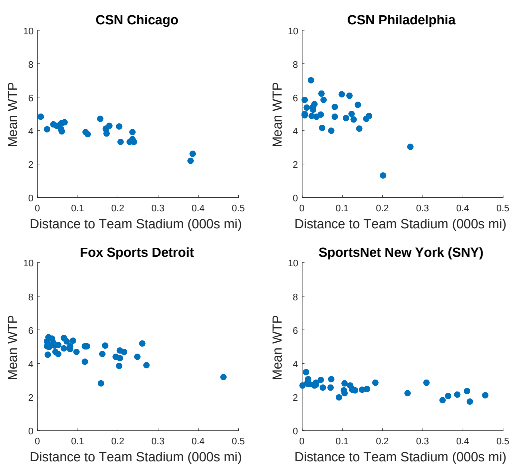
The willingness-to-pay (WTP) for each channel can be derived by computing the contribution of a given channel to bundle utility for each household (v^*_{ijt} in (2)), multiplying it by our estimates of parameters β^v/α to convert it into dollars, and averaging across households (as households have different tastes (γ_{ict}) for each channel, which are distributed according to parameters $\boldsymbol{\rho}$).[61] We report estimated values of these parameters and WTPs in 2007 for all channels in Appendix Table A.4. We also depict the distribution of household WTPs for nine national channels, conditional on being positive, in Figure 5a, with the fraction of households with positive valuations listed for each channel. Although most national channels have average WTP values below \$1 per month (and other than sports channel ESPN, none exceed \$2), the pattern is very different for RSNs: none are predicted to have average WTP values less than \$1 per month, and over 70% are greater than \$2.

Our estimates of the RSN distance-decay parameter γ^d and blackout parameter γ^b are negative,

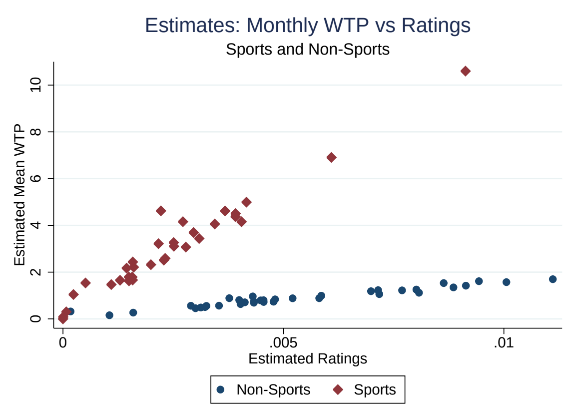
[61] We compute the average WTP for channels relative to a synthetic bundle that includes every national channel carried by at least 60% of systems in 2007, and by using 20,000 simulated households. When computing the WTP for an RSN c, we add the RSN to the synthetic bundle and use the average values of b_{ict} and d_{ic} across all markets that carry the RSN.



(a) Histograms of monthly WTP (conditional on being positive) for selected national channels.



(b) Mean WTP in a market versus distance to RSN's teams' stadiums, for four RSNs.



(c) Estimated monthly WTP versus estimated ratings for sports and non-sports channels

Figure 5: Predicted willingness-to-pay (WTP) for channels (2007 values).

and imply that consumers derive less utility from watching an RSN both (i) the further they are from the teams carried on the RSN, and (ii) the greater the fraction of teams that are blacked out. We predict that increasing the average distance of a household from an RSN's teams' stadiums from 0 to 100 miles reduces that household's value of the channel by approximately 9%.[62] Figure 5b illustrates this pattern, and plots the predicted average WTP in 2007 for four different RSNs as

[62] As distance is measured in thousands of miles, being further away by 100 miles scales utility by $\exp(\hat{\gamma}^d \times 0.1)$.

Table 3: Elasticities and Margins

Elasticity of row with respect to price of column:	Cable	DirecTV	Dish
Cable	-1.69	0.30	0.19
DirecTV	2.16	-2.90	0.13
Dish	3.18	0.22	-4.15
Outside Option	5.52	0.26	0.16
Predicted Margins			
Mean Comcast Margin	0.66		
Mean DirecTV Margin	0.48		
Mean Dish Margin	0.45		
Logit Demand Price Coefficients			
OLS Logit Price Coefficient	-0.004**	(0.002)	
IV Logit Price Coefficient	-0.080***	(0.025)	
Semi-Elasticity of row with respect to removal of ESPN from column:	Cable	DirecTV	Dish
Cable	-18.90	3.86	2.36
DirecTV	54.82	-19.52	1.11
Dish	51.16	1.85	-19.67
Outside Option	17.27	0.22	0.14

Notes: This table reports predicted mean price elasticities, predicted margins for Comcast and the two satellite distributors, the estimated price coefficient from a logit demand regression without (OLS) and with (IV) the use of price instruments (where standard errors clustered at market level), and semi-elasticities from dropping the national channel ESPN. For logit demand estimates, **, *** represent significance at the 5% and 1% levels.

the distance from a household to an RSN's teams' stadiums increases.[63] Similarly, we predict that subjecting half of the teams that an RSN normally broadcasts to blackout restrictions reduces consumers' valuation of the channel by 25%.

Finally, we estimate ν^{NS} to be different than ν^{S}. The lower estimated value of ν^{NS} implies that consumers' marginal utility from watching non-sports channels falls slower than for sports channels; in turn, this implies that consumers derive higher utility from sports channels than non-sports channels if they choose to spend the same amount of time spent watching each. Our model thus predicts that sports channels receive higher negotiated affiliate fees for the same viewership ratings, as depicted in Figure 5c for the year 2007.

5.2 Distributor Choice Parameters

All reported coefficients in $\boldsymbol{\theta}_2$ are statistically significant at the 5% level, and have the expected sign: consumers negatively respond to price (α), and positively respond to the indirect utility they receive from a bundle's channels (β^v).

At the top of Table 3 we report the average own- and cross-price elasticities that are predicted by our model. Demand for the average cable system is more inelastic (-1.7) than for satellite (-2.9

[63] Each point in Figure 5b corresponds to a market in which the RSN is carried in 2007, and the WTP for each market is computed by averaging over 160 simulated households per market using that market's value of b_{ict} and d_{ic}.

and -4.2), which is consistent with higher cable market shares and margins that are both observed in the data and predicted by our model.[64] Estimated values of $\rho^{sat}_{DirecTV}$ and ρ^{sat}_{Dish} indicate consumers have substantial heterogeneity in their valuation for satellite bundles (a standard deviation of approximately \$40 per month); as discussed earlier, such heterogeneity assists the model in matching observed Comcast, DirecTV, and Dish price-cost margins. The implied average predicted margins are given in the second panel of Table 3.

To illustrate the efficacy of instruments described in the previous section (which include satellite taxes), the third panel of Table 3 reports the results from a logit demand regression.[65] Instrumenting for price yields a 22 times larger estimated price coefficient, consistent with the presence of a positive correlation between prices and unobservable bundle characteristics.

The bottom panel of Table 3 reports the semi-elasticity for MVPDs and the outside option given the removal of ESPN from each type of distributor (cable or either of the two satellite providers). For example, the removal of ESPN from DirecTV's bundles implies that its own market share would fall by 19.5%, while those for cable and Dish would increase by 3.9% and 1.8% respectively. This implies that for every 1000 households that would leave DirecTV if it lost access to ESPN, 920 would substitute to cable, 67 would substitute to Dish, and 13 would go to the outside option. These types of diversion figures, and in particular those to cable, play a central role in the incentives of an integrated cable provider to deny access to a rival satellite distributor.

5.3 Pricing, Bargaining, Carriage and Foreclosure Parameters

We now discuss the parameters contained in $\boldsymbol{\theta}_3$ which govern a firm's pricing, bargaining and carriage decisions, as well as our rival foreclosure parameter λ_R.

First, we estimate that the variance of firms' bundle-market-time specific profit shocks ($\hat{\sigma}^2_\omega$) is neither economically nor statistically significant. We estimate that channels capture more than half of the gains from trade when bargaining, although less with integrated distributors ($\hat{\zeta}^I = 0.38$) than non-integrated distributors ($\hat{\zeta}^E = 0.28$).

[64] Our estimates can be compared to Goolsbee and Petrin (2004), who estimate household demand for satellite, basic cable, premium cable, and local antenna using 2001 data; they obtain an expanded basic cable own-price elasticity of -1.5, and an overall satellite own-price elasticity of -2.5. They do not observe cross-sectional variation in prices for satellite distributors, and rely on Slutsky symmetry to identify satellite price elasticities. Our estimated own-price elasticity for cable is similar, and the overall satellite own-price elasticity implied by our own- and cross-price elasticity estimates for DirecTV and Dish, computed at average market shares during our sample period (see Table A.1), is -3.2.

[65] For 20,784 firm-market-year bundles, the dependent variable is the log of the ratio of market shares for the bundle to the outside option, and the OLS regressors are firm-state and year fixed effects, channel fixed effects for all channels contained in the bundle, and price. The excluded instruments for price in the IV regression are the satellite tax within the market interacted with an indicator for whether the bundle is offered by a satellite or cable distributor, and the maximum fraction of teams not blacked out within the market across all RSNs for which the market is relevant. The F-statistic on the excluded instruments in the first stage regression of price is 425.4; the t-statistic for satellite taxes interacted with a satellite distributor indicator in the first stage price regression is 35; and the R^2 from the regression is 0.52. Additionally, an important input into distributor demand elasticities with respect to carriage is the coefficient on mean viewership utility in the distributor choice utility equation in (2). The first stage regression of v^*_{fmt} on the same set of instruments for price results in an F-statistic on the excluded instruments of 389.4; the t-statistic for the maximum fraction of teams not blacked out is 33; and the R^2 from the regression is 0.56.

Our estimated value of μ indicates that firms internalize a substantial fraction, but not all, of the profits of other integrated units when making decisions. Only \$0.79 of each dollar of profit realized by its integrated partner is internalized when an integrated MVPD makes pricing and carriage decisions, or when integrated MVPDs and RSNs bargain with each other. The discussion in Section 3.4.3 suggested $\zeta_{fc} \times (1 + \mu_{fc})$ as a (rough) measure of the alignment of downstream carriage and pricing decisions with joint profit maximization for a channel and MVPD.[66] Our estimates imply that this quantity is 0.28 with non-integration, and 0.66 with a fully-integrated channel. This difference is statistically significant at standard confidence levels. Moreover, we reject both $\hat{\mu} = 1$ and $\hat{\zeta}^I \times (1 + \hat{\mu}) = 1$, indicating that integration does not lead to full joint profit maximization.

Our estimated lower bounds for $\mu \times \underline{\lambda}_R^{Phil}$ and $\mu \times \underline{\lambda}_R^{SD}$ are 1.11 and 0.94. Figure 6 graphs the total three party surplus—given by the left-hand side of (22)—between the integrated channel and the two satellite distributors in the two loophole markets we examine (Philadelphia and San Diego). We see that for values of $\mu \times \lambda_R$ lower than 0.94, it is not an equilibrium for either channel to exclude both satellite distributors as there would be a profitable deviation, for some negotiated set of affiliate fees, for the channel to be supplied. However, for values between approximately 0.94 and 1.11, we can rationalize exclusion in San Diego but not Philadelphia. Only for values of $\mu \times \lambda_R \geq 1.11$ does our model rationalize exclusion in both of these loophole markets. These results indicate that integrated channels' supply decisions vis-à-vis non-integrated rival distributors are significantly affected by foreclosure incentives; these weights placed on the benefits of rival foreclosure for the channel's integrated distributors are not stastically significantly different from 1.[67]

6 The Welfare Effects of Vertical Integration

In this section we use our model's estimates to examine how vertical integration affects affiliate fee negotiations (including whether supply occurs at all), distributors' pricing and carriage decisions, and—ultimately—firm and consumer welfare. We focus on 26 RSNs that were active in 2007, 13 of which were (at least partially) integrated with a downstream distributor (10 with a cable MVPD, 3 with DirecTV).[68] Of these integrated RSNs, two—CSN Philadelphia and 4SD—were owned by cable distributors in "loophole" markets, and were not provided to satellite.

For each of these RSNs we simulate market outcomes for the year 2007 that would have occurred

[66] Specifically, $\zeta_{fc} \times (1 + \mu_{fc}) = 1$ would lead to joint profit-maximizing carriage and pricing decisions when the MVPD operates in a single market.

[67] Given $\hat{\mu} = 0.79$, these estimates imply that $\underline{\lambda}_R^{Phil}$ is at least 1.4 and $\underline{\lambda}_R^{SD}$ at least 1.3, which corresponds to the integrated channel placing more weight on its integrated distributor's benefits from foreclosure than the channel and distributor place on each other's profits when pricing, making carriage decisions, and bargaining with each other. However, we cannot reject the hypothesis that either of these values differ from 1: the 95% confidence interval for $\hat{\underline{\lambda}}_R^{Phil}$ is $[0.97, 1.93]$ and $\hat{\underline{\lambda}}_R^{SD}$ is $[0.82, 1.70]$.

[68] We exclude from our analysis 3 cable-integrated RSNs (CSN Northwest, Comcast/Charter Sports Southeast, and Cox Sports TV) and one independent RSN (YES) that did not supply satellite providers in markets where PARs were in effect, as our model does not explain this exclusion.

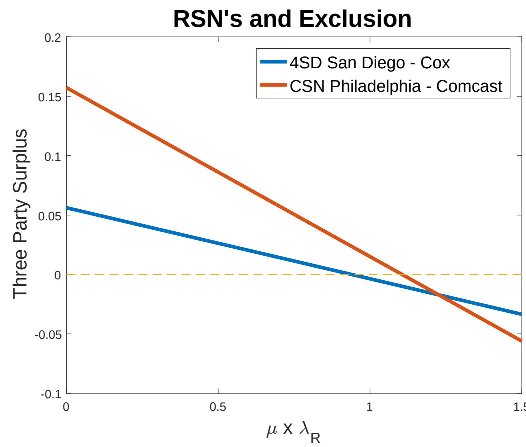


Figure 6: Three-party surplus between the integrated cable MVPD, DirecTV, and Dish as a function of $\mu \times \lambda_R$ in Philadelphia and San Diego.

in the RSN's relevant markets under the following three *integration scenarios*: (1) Non-integration, (2) Integration with PARs, and (3) Integration without PARs.[69] More specifically:

(i) Non-Integration: In this scenario, we assume that $\mu = 0$ and $\lambda_R = 0$ so that all firms behave as if they are non-integrated (i.e., no MVPD or channel internalizes the profits of any other unit).

(ii) Integration and PARs: In this scenario, if the RSN being examined is non-integrated in the data, we assign full ownership of the channel to the largest cable MVPD in that RSN's relevant markets; if the RSN is integrated, we do not change its ownership structure. We then assume that μ is equal to our estimated value $\hat{\mu} = 0.79$, but that $\lambda_R = 0$: i.e., we assume that integrated distributors and channels partially internalize each other's profits when bargaining with each other over affilliate fees, and when the integrated distributor is pricing and making carriage decisions, but that program access rules prevent the channels from considering the benefits of foreclosure to its integrated distributor when bargaining with rival distributors.

(iii) Integration and no-PARs: In our final scenario, we follow the same setup as in the "Integration and PARs" scenario, but assume that $\lambda_R = \hat{\underline{\lambda}}_R^{Phil}$, the larger of our two recovered lower bounds.[70] The RSN therefore internalizes the profits of its downstream integrated units when bargaining with other downstream distributors, and thus may find it unprofitable to supply downstream rivals.

[69]We simulate the equilibrium under all three scenarios for each RSN, including whichever scenario occurred in the data for the RSN.

[70]The value of λ_R must be at least $\hat{\underline{\lambda}}_R^{Phil}$ to rationalize the non-supply of the satellite distributors that we observe in both Philadelphia and San Diego. If $\lambda_R > \hat{\underline{\lambda}}_R^{Phil}$, foreclosure incentives would be larger than those considered here; we explore the effects of larger values of λ_R in Section 6.3.

For each integration scenario and each RSN, we solve for a set of bundle prices, carriage decisions, and negotiated affiliate fees that satisfy the necessary equilibrium conditions given by equations (5), (6), and (11). Under non-integration and integration with PARs (scenarios (i) and (ii)), we assume that all RSNs are supplied to all distributors.[71] Under scenario (iii), where channels are integrated but PARs are not in effect, we also solve for the RSN's equilibrium supply decision. To determine whether or not each rival distributor is supplied with the channel, we test which supply outcomes (e.g., if a cable integrated RSN supplies both, neither, or either one of the two satellite distributors) are consistent with equilibrium.[72]

In our main counterfactual results, we assume that a change in ownership for a single RSN does not cause national satellite prices to adjust, and we thus hold satellite prices fixed at observed levels. In Section 6.3, we also examine counterfactuals under the alternative assumption that satellite prices are determined at the DMA level, and may adjust across our integration scenarios. Further computational and implementation details are provided in Appendix C.4.

6.1 Potential Effects

Before proceeding, it is instructive to highlight the effects of vertical integration that are captured by our model and that we attempt to quantify. Our model emphasizes three main supply-side decisions: (i) negotiations over supply and affiliate fees between channels and distributors, and both (ii) channel carriage (conditional on supply) and (iii) bundle pricing by distributors.

Suppose, then, that MVPD f integrates with RSN c, and that there is a rival MVPD g. The following effects of vertical integration are admitted in our setting:

1. **Bargaining Effects and Foreclosure:** When integration occurs there are effects on both internal and external bargaining. As discussed in Section 3.4.3, we expect the effective internal affiliate fee paid by the integrated distributor f to fall when integration occurs: i.e., our 0.79 estimated value of μ indicates that the RSN and distributor f internalize (most of) each

[71] Aside from the two loophole RSNs, all other RSNs in our counterfactuals were provided to all distributors in 2007.

[72] At the set of affiliate fees, prices, and carriage decisions that satisfy the necessary equilibrium conditions under each potential supply outcome, for each cable-owned channel in scenario (iii) we test: (a) whether supplying both satellite providers is an equilibrium by examining if there are positive bilateral gains from trade between the RSN and each satellite provider given that the other satellite provider is supplied; (b) whether supplying only one satellite distributor is an equilibrium by examining if there are positive gains from trade between the RSN and the supplied satellite distributor given that the other satellite provider is not supplied, and if there are no bilateral gains from trade between the RSN and the non-supplied satellite distributor given that the other satellite provider is supplied; and (c) whether supplying neither satellite distributor is an equilibrium by examining if the *three-party-surplus* given by the left-hand side of (22) is negative. For all RSNs but two, exactly one supply outcome was robust to these tests. For two RSNs, exactly two supply outcomes satisfied these tests: for CSN Philadelphia, they were the non-supply of both satellite distributors and the supply of only DirecTV; for NESN, they were the non-supply of both or supply of both. We report results assuming that the outcome with the least supply is chosen (as this outcome maximized the integrated firms' profits given our parameter estimates). For each of the three RSNs owned by DirecTV, we determine supply by verifying that the bilateral surplus generated by the RSN's supply of each cable MVPD in the RSN's relevant markets as well as Dish Network is positive (where surpluses are computed at updated levels of affiliate fees, prices, and carriage decisions).

others' payoffs. Of course, in equilibrium, the internal affiliate fee is also affected by any changes in carriage and pricing as these can change both f and c's gains from trade.

The effects of integration on *external* bargaining will depend on whether PARs are in effect or not. When PARs are in effect, RSN c ignores any benefits to its integrated distributor f's profits from denying access to rival distributor g, just as if c was not integrated. However, the negotiated affiliate fee to g may still be affected by changes in f's carriage and prices, which can affect g's benefit from getting access to c, and by any change in the internal affiliate fee that c receives from f (which would alter how supply of g affects c's profit).

Finally, when c bargains with the rival MVPD g and PARs are *not* in effect, c internalizes the lost profit of its integrated downstream distributor f if g is supplied (since $\lambda_R > 0$). As a result, the gains-from-trade that accrue to c by supplying g are reduced from what they would be under either non-integration or in the presence of PARs, potentially leading to a higher negotiated affiliate fee τ_{gct} or—if gains-from-trade are eliminated altogether—non-supply. Again, however, any induced changes in carriage and pricing can also affect negotiated input fees.

2. **Carriage Effects:** When vertical integration occurs, the fact that μ is positive makes the integrated f internalize the effects of its carriage of RSN c on c's profit. As carriage is likely to increase c's profit due to the increase in affiliate fees earned from f (although an offsetting effect is that f's carriage of c may lower c's affiliate fee revenues earned from g, by reducing g's market share), integration may lead f to increase carriage of RSN c. The net impact on carriage will also depend on equilibrium price adjustments and whether rival distributors are still supplied with the channel.

3. **Pricing Effects:** As with the carriage decision, an integrated f will internalize effects of its pricing on RSN c's profit. This is likely to push f toward charging a lower bundle price—i.e., reducing double marginalization—as a lower price will increase f's market share, and hence the affiliate fees that c collects from f (although, as described above, there is a potentially offsetting effect from any reduced affiliate fees earned from g, as in Chen 2001). In addition, changes in carriage will have a separate effect on f's pricing; for example, if carriage increases, the resulting increased bundle quality is likely to push f to increase prices in those markets where c is added to its bundle relative to what its prices would have been absent the carriage change.

Thus, while we expect integration to increase carriage and reduce double marginalization by integrated distributors, and the absence of PARs to increase foreclosure of and affiliate fees paid by rival distributors of integrated firms, confounding effects are present that may upset these expectations. Moreover, even if the directions of these effects are as expected, their magnitudes, and their overall impacts on consumer and aggregate welfare remain empirical questions that our counterfactual simulations aim to address.

Table 4: Simulated Market Outcomes for Selected RSNs

		(i) No VI	(ii) VI PARs		(iii) VI No PARs	
			(vs. No VI)		(vs. No VI)	
		Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
CABLE INTEGRATED RSNs						
CSN PHIL	Cable Mkt Share	0.64	0.8%		1.8%	
Comcast		[0.62,0.65]	[0.2%,2.4%]		[0.6%,4.0%]	
Pop 4.25M	Sat Mkt Share	0.18	-0.5%		-10.4%	
Footprint 90%		[0.17,0.19]	[-3.3%,-0.2%]		[-14.8%,-0.5%]	
WTP $4.99	Cable Carriage	0.95	1.6%		0.4%	
		[0.62,0.97]	[0.0%,53.8%]		[-6.2%,52.9%]	
	Cable Prices	54.31	-0.5%		0.9%	
		[53.28,55.42]	[-1.5%,0.9%]		[-1.4%,1.8%]	
Foreclose: 85%	Aff Fees to Sat	2.26	3.6%		-	
		[1.00,2.64]	[-9.4%,7.0%]		-	
	Cable + RSN Surplus	30.19	0.2%	0.9%	1.1%	6.5%
		[14.57,32.67]	[0.0%,2.4%]	[0.3%,13.7%]	[0.4%,3.3%]	[3.0%,20.5%]
	Satellite Surplus	4.29	-0.9%	-0.8%	-2.1%	-1.8%
		[1.26,4.70]	[-3.4%,-0.4%]	[-2.4%,-0.5%]	[-4.8%,-1.1%]	[-4.5%,-0.9%]
	Consumer Welfare	31.21	0.6%	3.9%	-2.9%	-18.1%
		[16.82,34.81]	[0.2%,2.0%]	[1.4%,12.7%]	[-3.3%,1.5%]	[-21.8%,9.9%]
	Total Welfare	65.69	0.3%	4.0%	-1.0%	-13.4%
		[31.14,71.73]	[0.1%,1.9%]	[2.0%,25.2%]	[-1.1%,1.1%]	[-15.6%,14.7%]
MSG	Cable Mkt Share	0.63	3.3%		3.3%	
Cablevision		[0.62,0.67]	[0.3%,4.8%]		[0.2%,4.7%]	
Pop 11.7M	Sat Mkt Share	0.18	-4.3%		-4.3%	
Footprint 42%		[0.17,0.18]	[-7.1%,-0.4%]		[-8.1%,-0.4%]	
Pred WTP $2.32	Cable Carriage	0.68	10.5%		10.5%	
		[0.67,0.87]	[-2.5%,18.5%]		[-3.1%,18.5%]	
	Cable Prices	59.40	-2.4%		-2.4%	
		[56.80,60.81]	[-3.5%,0.0%]		[-3.5%,0.2%]	
Foreclose: 1%	Aff Fees to Sat	1.22	-3.3%		22.4%	
		[0.42,1.28]	[-5.9%,10.4%]		[17.1%,53.4%]	
	Cable + RSN Surplus	30.64	0.3%	4.4%	0.5%	6.8%
		[14.61,34.12]	[-0.1%,0.6%]	[-1.6%,7.4%]	[0.0%,1.3%]	[0.4%,14.6%]
	Satellite Surplus	4.16	-4.2%	-7.5%	-5.5%	-9.9%
		[1.24,4.48]	[-7.2%,-0.5%]	[-12.1%,-0.9%]	[-8.5%,-1.2%]	[-14.3%,-2.4%]
	Consumer Welfare	33.80	3.1%	44.6%	3.0%	44.3%
		[18.38,38.14]	[0.3%,4.3%]	[4.4%,66.3%]	[-0.4%,4.3%]	[-6.3%,66.0%]
	Total Welfare	68.60	1.4%	41.4%	1.4%	41.2%
		[32.06,76.01]	[0.1%,1.9%]	[3.4%,60.9%]	[0.1%,1.9%]	[2.5%,60.7%]
NON-INTEGRATED RSN						
NESN	Cable Mkt Share	0.61	7.6%		9.4%	
*Comcast		[0.59,0.65]	[1.6%,11.2%]		[2.7%,12.5%]	
Pop 5.20M	Sat Mkt Share	0.13	-7.8%		-22.3%	
Footprint 85%		[0.12,0.14]	[-12.6%,-1.8%]		[-26.5%,-7.2%]	
WTP $6.91	Cable Carriage	0.92	6.2%		3.6%	
		[0.68,0.98]	[0.0%,33.1%]		[-0.5%,38.1%]	
	Cable Prices	56.73	-4.7%		-3.9%	
		[54.24,57.88]	[-6.6%,-0.5%]		[-6.0%,0.6%]	
Foreclose: 96%	Aff Fees to Sat	3.32	3.1%		-	
		[1.23,3.79]	[-12.6%,16.9%]		-	
	Cable + RSN Surplus	28.38	0.9%	3.6%	2.0%	8.2%
		[13.68,31.36]	[0.1%,2.4%]	[0.9%,10.6%]	[0.7%,4.0%]	[5.4%,16.7%]
	Satellite Surplus	2.96	-8.3%	-3.5%	-10.9%	-4.7%
		[0.84,3.24]	[-13.2%,-1.8%]	[-5.5%,-1.3%]	[-13.9%,-3.0%]	[-6.3%,-1.7%]
	Consumer Welfare	28.36	6.4%	26.5%	3.3%	13.5%
		[15.54,31.97]	[1.4%,10.0%]	[8.2%,40.8%]	[-1.7%,7.1%]	[-9.0%,29.2%]
	Total Welfare	59.70	3.1%	26.5%	2.0%	17.0%
		[29.79,65.84]	[0.5%,5.1%]	[7.8%,43.7%]	[-0.2%,4.5%]	[-2.5%,37.5%]

Notes: Scenarios (i)-(iii) correspond to the integration scenarios described at the beginning of Section 6. Beneath the RSN name is either the name of the RSN's owner (observed or, if non-integrated, assigned, which is denoted by *), the number of television households in the RSN's relevant markets, the MVPD owner's footprint (% of households passed) in the RSN's relevant markets, and the estimated mean consumer WTP for the RSN. Scenario (i) reports household weighted averages over all relevant markets for each RSN, where all levels except for market shares and cable carriage are in $/household/month. Scenarios (ii) and (iii) report changes from scenario (i), where $\%\Delta_{lvl}$ (respectively, $\%\Delta_{WTP}$) represent changes from scenario (i) expressed as a percentage of changes in household weighted averages of levels (respectively, estimated mean consumer WTP for the channel). Affiliate fees to satellite are reported conditional on supply; missing values indicate foreclosure. 95% confidence intervals, constructed from 150 simulations, are reported below each figure; the fraction of simulations in which the RSN is predicted to foreclose at least one rival distributor under scenario (iii) is reported last under each RSN's name ("Foreclose: %"). Results for all other RSNs are contained in Appendix Tables A.5-A.10.

6.2 Results

6.2.1 Individual RSN Results

As an illustration of the kinds of effects we see for individual RSNs, Table 4 reports market shares, channel carriage, cable prices, firm profits, and consumer and total welfare across our three different integration scenarios for three RSNs: CSN Philadelphia, a cable-integrated RSN located in a terrestrial loophole market; MSG, a cable-integrated RSN located in a non-loophole market; and NESN, a non-integrated RSN. Below each RSN name is the MVPD that owns the channel (or is assigned ownership under integration scenarios (ii) and (iii) if the RSN is non-integrated, denoted by a * next to the assigned owner's name), the number of households and the MVPD owner's "footprint" (the percentage of these households that the MVPD "passes" or plausibly could serve) in the RSN's relevant markets, and the estimated mean consumer willingness-to-pay (WTP) for the RSN.

The values shown for scenario (i), corresponding to no vertical integration ("No VI"), are household weighted average levels across an RSN's relevant markets; with the exception of market shares and cable carriage, reported numbers are in dollars per household per month. For integration scenarios (ii) and (iii), "VI PARs" and "VI No PARs" respectively, we report changes from non-integration scenario (i) either as a percentage of non-integration levels (denoted $\%\Delta_{lvl}$) or as a percentage of the mean WTP for the RSN (denoted $\%\Delta_{WTP}$). A missing value for "Aff Fees to Sat" indicates that the RSN is predicted to be withheld from the two satellite distributors. Confidence intervals are constructed by taking 150 draws from the joint distribution of the estimated coefficients and re-computing the equilibrium for each draw. The fraction of the scenario (iii) draws for which the RSN is predicted to foreclose and not supply at least one rival distributor is also shown last under each RSN name ("Foreclose: %").

For each of the three RSNs shown in Table 4 vertical integration with PARs in effect leads the integrated distributor to increase carriage and reduce its bundle price at our point estimates, and in each case we can reject a zero effect for at least one of the carriage or price effects. Cable's market share increases in each case, and satellite's share decreases; as well, satellite surplus falls, consumer welfare increases, and total welfare rises (all such effects are statistically significant).

When integration occurs without PARs in effect, two of these three RSNs—CSN Philadelphia and NESN—deny access to both rival satellite producers. Despite this exclusion, only for CSN Philadelphia are the point estimates for the effects of vertical integration on consumer and total welfare negative, and for neither of these two RSNs can we reject zero net consumer and total welfare effects. For the third RSN, MSG, the two satellite distributors continue to have access to the RSN, although paying higher affiliate fees (22.4% higher according to our point estimates, and statistically significantly different from zero). For all three RSNs, vertical integration without PARs in effect lowers the satellite distributors' profits by between 2-11% (statistically significant in each case).

Results for all other RSNs are contained in Appendix Tables A.5-A.10. Overall, the outcomes for different RSNs display considerable heterogeneity.

6.2.2 Average Results

We now turn to the average effects of vertical integration. Table 5 reports market outcomes for each of the three vertical integration scenarios, averaged across RSNs and weighted by the number

Table 5: Average Simulated Market Outcomes Across All RSNs

	(i) No VI	(ii) VI PARs		(iii) VI No PARs			
		(vs. No VI)		(vs. No VI)		(vs. VI PARs)	
	Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
ALL RSNs							
Cable Mkt Share	0.60	2.1%		2.2%		0.1%	
	[0.59,0.62]	[0.4%,2.6%]		[0.4%,2.6%]		[-0.2%,0.3%]	
Sat Mkt Share	0.20	-2.0%		-2.7%		-0.8%	
	[0.20,0.21]	[-2.6%,-0.4%]		[-4.1%,-0.8%]		[-2.6%,-0.0%]	
Cable Carriage	0.72	9.4%		8.6%		-0.7%	
	[0.66,0.80]	[3.1%,21.5%]		[0.8%,19.1%]		[-4.4%,0.9%]	
Cable Prices	55.10	-1.2%		-1.1%		0.1%	
	[54.25,55.90]	[-1.5%,-0.1%]		[-1.4%,-0.0%]		[0.0%,0.3%]	
Aff Fees to Rivals[a]	1.36	-0.7%		17.1%		18.0%	
	[0.54,1.45]	[-3.2%,4.4%]		[11.0%,28.5%]		[12.1%,28.6%]	
Cable + RSN Surplus	23.04	0.3%	3.1%	0.6%	5.0%	0.2%	1.9%
	[11.13,25.17]	[0.1%,0.6%]	[1.4%,5.4%]	[0.2%,0.9%]	[2.6%,8.1%]	[0.1%,0.5%]	[0.5%,4.2%]
Satellite Surplus	5.10	-2.2%	-4.3%	-3.2%	-6.0%	-1.0%	-1.7%
	[1.56,5.51]	[-3.1%,-0.5%]	[-6.7%,-0.3%]	[-3.9%,-1.0%]	[-8.4%,-1.1%]	[-1.3%,-0.4%]	[-2.5%,-0.6%]
Consumer Welfare	30.99	1.5%	18.0%	1.3%	16.2%	-0.2%	-1.7%
	[16.15,34.47]	[0.3%,1.8%]	[5.5%,23.8%]	[-0.1%,1.5%]	[-1.3%,20.4%]	[-0.7%,-0.1%]	[-8.4%,0.0%]
Total Welfare	59.13	0.7%	16.8%	0.6%	15.3%	-0.1%	-1.5%
	[27.59,64.41]	[0.1%,0.9%]	[5.4%,22.2%]	[0.0%,0.8%]	[0.8%,18.7%]	[-0.2%,-0.0%]	[-6.4%,0.1%]
# Foreclosed:				4/26 [0,9]			

Notes: Average simulated market outcomes across the 26 RSNs in our analysis, weighted by the number of households in each RSN's relevant markets. Percentages are the averages of percentage changes across RSNs, weighted by the number of households in each RSN's relevant markets. "# Foreclosed" reports the number of RSNs that are not provided to rival distributors under (iii) VI No PARs. See Table 4 and main text for additional details.
[a] "Fees to Rival" represents average affilliate fees (to the satellite MVPDs for cable-integrated RSNs, and to cable MVPDs and the rival satellite distributor for satellite-integrated RSNs) *conditional on supply* in each relevant scenario.

of households in each RSN's relevant markets. The structure is the same as in Table 4, with the following adjustments. First, "Aff Fees to Rivals" represents the weighted average of the affiliate fees charged to the integrated MVPD's rival distributors (weighted by the number of households in each of the RSN's relevant markets), conditional on the channel being supplied to those distributors. These rival distributors are the two satellite distributors if the channel is cable-integrated; if instead the channel is DirecTV-integrated, these rivals are the cable distributors in the RSN's relevant markets and Dish. Second, "# Foreclosed" represents the number of RSNs that are not provided to at least one rival distributor for the case of integration without PARs in effect (integration scenario (iii)). Third, in the rightmost two columns, we report the weighted average change in predicted outcomes between scenarios (ii) and (iii); these changes are expressed both as percentages of scenario (ii) levels and of an RSN's estimated mean WTP, and isolate the impact of program access rules given integration. All reported percentages are the averages of percentage changes across RSNs, weighted by the number of households in each RSN's relevant markets.

Efficiency Effects: Reduction of Double Marginalization and Increased Carriage. We first focus on the potential efficiency gains from vertical integration. These are highlighted by the differences between integration scenario (ii) with PARs and non-integration scenario (i), reported in the second and third columns of Table 5.

Across all RSNs, we predict that integration of a single RSN when PARs are in effect yields on average a (statistically significant) 9.4% increase in carriage of the RSN by cable distributors.[73] It

[73]This average includes carriage changes by cable operators for the three satellite-owned RSNs.

also results on average in a (statistically significant) 1.2% decrease in cable prices (corresponding to an average \$0.67 reduction in the price consumers pay).[74,75] As discussed in Section 6.1, pricing reductions arise primarily from the reduction of double marginalization. However, there are offsetting effects that may mitigate downward pricing incentives: integrated distributors now internalize affiliate fees paid by rival MVPDs, and (as we have noted) carriage of the RSN by cable providers increases when the channel is integrated (thereby increasing the utility delivered by bundles in certain markets). Even so, cable prices fall on average.[76]

We find that joint RSN and integrated cable surplus increases on average when moving from non-integration to integration with PARs: when a cable MVPD is integrated (and since $\hat{\mu}$ is greater than 0), its pricing and carriage decisions will partially internalize RSN profits (even if, under PARs, the channel does not act upon rival foreclosure incentives). Satellite surplus, on average across all RSNs, falls by 2.2% when RSNs are integrated with PARs in effect.[77] Consumer welfare and total welfare increase by, on average, 1.5% and 0.7% respectively (18.0% and 16.8%, respectively, as percentage gains of WTP for the RSN). The change in total welfare represents an average increase of \$0.43 per household per month. Each of these changes is statistically significant.

We find that consumer welfare gains arise primarily from lower cable prices: if we hold cable prices fixed at non-integrated levels and re-compute equilibrium outcomes (including carriage and affiliate fees) under integration with PARs, average consumer welfare gains across all RSNs are 0.3%; holding fixed carriage rates at non-integrated levels and re-computing equilibrium outcomes yields average consumer welfare gains of 1.5%.[78]

Foreclosure Effects: Raising Rivals' Costs and Exclusion. The comparison of scenarios (ii) and (iii), shown in the last two columns of Table 5 provides the impact of removing PARs given that RSNs are integrated, and isolates the impact of foreclosure incentives on market outcomes. Allowing foreclosure is predicted to reduce both consumer and total welfare from the integration scenario with PARs by 0.2% and 0.1%, respectively; both are statistically significant, and represent average changes of 1.7% and 1.5% as a percentage of the WTP for the RSN.

The reduction in welfare from the absence of PARs stems primarily from two effects. The first occurs when an RSN is completely withheld from rival MVPDs. Though we predict that none of the three DirecTV-owned RSNs would choose to exclude cable providers, we predict that

[74] The values reported for scenarios (ii) and (iii) in Tables 4-5 are the (household weighted) averages of percentage changes, not the percentage change in the average levels. Thus, the average \$0.67 decrease in price that we describe here does not equal the product of the values in the first and second columns of Table 5.

[75] Though integration of most RSNs yields less than a 1% decrease in cable prices, there are several cases where price decreases are larger: e.g., integrating NESN with Comcast, reported in the bottom panel of Table 4, results in average cable prices falling by nearly 5% (corresponding to an average reduction in the price consumers pay of \$2.67) due to NESN's high estimated affiliate fees to Comcast (predicted to be approximately \$4.70 per month).

[76] In fact, we find that average cable prices do not increase for any individual RSN upon integration in the presence of PARs.

[77] This percentage includes both cable and satellite integration of RSNs, although it is primarily reflecting cable ownership of RSNs. In Appendix Table A.7, we report market outcomes for the three satellite integrated RSNs.

[78] These partial effects, calculated from the same non-integration baseline, do not sum to the total equilibrium effect when prices, carriage, and affiliate fees adjust.

Table 6: Welfare Changes From Foreclosure

Percentage change in levels between (ii) VI PARs and (iii) VI No PARs		
	%Δ Consumer Welfare	%Δ Total Welfare
Are Rival Distributors Excluded	-1.95***	-0.72***
	(0.53)	(0.22)
N	3900	3900
R^2	0.52	0.52

Notes: Regression where the dependent variable is the percentage change in either consumer or total welfare in levels between integration scenarios (ii) and (iii) (with and without PARs in effect). Each observation is an RSN-counterfactual simulation (26×150). Specifications include RSN fixed effects. Standard errors clustered at RSN level, and *** represents significance at the 1% level.

Table 7: Probability of Exclusion

Exclusion of Rival Distributors by Integrated RSN (Without PARs)	
Footprint of Integrated Owner	0.67**
	(0.25)
WTP for RSN	0.07
	(0.05)
N	26
R^2	0.29

Notes: Linear probability regression where the dependent variable is whether rival distributors are denied access to an RSN under integration scenario (iii) without PARs. Each observation is an RSN. Specification includes a fixed effect for whether the RSN owner is a cable operator. ** represents significance at the 5% level.

3 out of the 14 RSNs integrated with a cable provider in the data (the two loophole RSNs and CSN New England) and one previously non-integrated RSN (NESN) would exclude both satellite distributors.[79] Conditional on integration occurring, exclusion of a rival distributor is associated with a negative change in welfare: Table 6 reports results from a regression of the change in consumer and total welfare between VI scenarios with and without PARs on whether or not rival distributors are denied access to the RSN. Results indicate that the exclusion of rival distributors is associated with a 1.9% and 0.7% reduction in consumer and total welfare, which roughly equals the predicted average welfare gains from integration with PARs ($\%\Delta_{lvl}$ in scenario (ii)).

To examine when exclusion is more likely to occur, Table 7 reports results from a linear probability regression of whether rival distributors are denied access to an RSN when PARs are not in effect; the footprint, or percentage of households in the RSN's relevant markets that the integrated distributor can serve, is positive and statistically significant. This is consistent with the discussion in Section 4.2 (i.e., larger cable footprints increase the potential losses incurred by an integrated cable provider from supplying the RSN to rival satellite distributors), and reflects the fact that the cable owners for the four RSNs that are predicted to foreclose satellite distributors all have greater than an 85% footprint.

The second effect that reduces welfare arises when an integrated RSN still supplies rival distributors but raises their affiliate fees, which in turn affects downstream distributor pricing and

[79]The 95% confidence interval for the number of RSNs that exclude is [0,9].

carriage. Table 5 indicates that affiliate fees for integrated RSNs charged to rivals, conditional on supply, increase on average by a statistically significant 18.0% from the levels predicted when PARs are in effect.[80] Even though we have assumed that satellite distributors do not adjust their prices in our counterfactuals, higher satellite affiliate fees can negatively harm consumer welfare by inducing the integrated cable owner to increase its own downstream prices or reduce its carriage. Intuitively, if a cable-integrated RSN increases its affiliate fees with satellite distributors, then the RSN's downstream cable MVPD sees a greater benefit to its integrated RSN from raising its price or reducing its carriage, which will move subscribers to the now higher-paying satellite distributors. Indeed, we find that cable prices increase, on average, by a small, but statistically significant 0.1%; carriage falls in our point estimates by 0.7%, although this change is not statistically significant.[81] Overall, removing PARs reduces satellite firms' surplus by a statistically significant 1.0% beyond the reduction caused by integration when PARs are in effect.

Net Effects. The comparison of scenarios (iii) and (i), shown in the fourth and fifth columns of Table 5, gives the overall *net* impact of integration of RSNs when PARs are not in effect. On average across all RSNs, the efficiency effects dominate the foreclosure effects when examining consumer and total welfare—both increase by approximately 1.3% and 0.6%, representing 15-16% of the total WTP generated by an RSN.[82] This is driven by an increase in RSN carriage (9% on average) and a reduction in cable prices (1.1%). However, satellite market shares and profits are predicted to fall by 2.7% and 3.2%, respectively, when RSNs are integrated.[83]

Looking separately at the 4 markets in which exclusion occurs at our point estimates, consumer and total welfare increase on average by small amounts (0.4% and 0.3% respectively) and we cannot reject zero effects. In contrast, consumer and total welfare rise on average by a statistically significant 1.4% and 0.7% respectively in the 22 markets in which exclusion does not occur.

6.2.3 "Perfect" Internalization

Although we reject that integration leads to full joint profit maximization, we have also conducted our counterfactual simulations using our main parameter estimates under the assumption that $\mu = \lambda_R = 1$.[84] Our findings are broadly similar: examining average changes between integration without

[80] In some cases this increase represents an increase of nearly \$0.50 per month per subscriber, as with CSN Mid-Atlantic (see Table A.6).

[81] This effect is discussed in Chen (2001). As a specific example, Comcast, the owner of CSN Mid-Atlantic, increases its own price of a bundle by \$0.11 between scenarios (ii) and (iii) as a result of negotiating a significantly higher affiliate fee for CSN Mid-Atlantic from satellite distributors.

[82] On average, consumer welfare rises by \$0.39 and total welfare by \$0.38 per household per month.

[83] These average net welfare changes mask considerable heterogeneity in the point estimates for individual RSNs. For instance, we find that foreclosure effects dominate for consumer welfare in the terrestrial loophole markets, where 4SD and CSN Philadelphia are predicted to exclude both satellite distributors, and reduce consumer welfare by 8-18% (\$0.13-0.90) of the average WTP generated by the channel. On the other hand, average net consumer welfare gains from integration for some RSNs reach approximately \$1 per household per month (e.g., \$1.03 for MSG and \$0.94 for NESN).

[84] For our simulations, we set $\mu = 0.99$ (which insures that internal negotiated affiliate fees are not indeterminate when $O_{fct} = 1$; see footnote 36) and $\zeta^I = 1/(1+\mu)$.

PARs and no integration (scenarios (iii) and (i)), we find that consumer and total welfare gains are slightly larger than at our estimated values of μ and λ_R (1.5% and 0.7%); this is attributable to larger increases in carriage (10.6%) and reductions in cable prices (-1.3%). These differences are not statistically significant.

6.3 Robustness

Internalization and Rival Foreclosure Parameters. We conducted our counterfactuals under the assumption that our rival foreclosure parameter λ_R equals the largest estimated lower bound across the two terrestrial loophole RSNs. However, it may be that this bound is not binding, and the value of λ_R is much larger. To understand the sensitivity of our results to this assumption, we have compared the average percentage change in consumer and total welfare between integration without PARs and no integration (scenarios (iii) and (i)) for different values of λ_R at our estimated parameter values. Under our main specification when $\lambda_R = \underline{\hat{\lambda}}_R^{Phil} = 1.4$, the predicted average changes in consumer and total welfare are 1.3% and 0.6%; at $\lambda_R = 2$, they are 0.4% and 0.3%, and at $\lambda_R = 3$, they are -0.2% and -0.03%. Thus, our rival foreclosure parameter would need to be significantly larger than our estimated lower bounds for the predicted overall average welfare effects from vertical integration (without PARs) to be reversed.

We also have estimated our model under the restriction that $\mu = \lambda_R = 1$.[85] Although $\mu = 1$ is rejected at our main parameter estimates, we find that our main counterfactual results are broadly unchanged; for the welfare figures reported in Table 5, all obtained percent changes in levels are not statistically different from those obtained using our unrestricted parameter estimates.

Satellite Re-Pricing. Our consideration of one vertical merger or divestiture at a time motivated our holding satellite distributors' prices fixed in our primary counterfactual specification—i.e., as each RSN is only active in a subset of markets, changes brought on by adjustments in its ownership might not warrant a change in either satellite distributor's *national* prices. However, were integration to increase nationally and lead to foreclosure or higher affiliate fees charged to satellite distributors in many markets, we may expect satellite prices to adjust, thereby altering our predicted welfare effects. To address this concern, we repeat our counterfactual simulations under the alternative assumption that satellite prices for both DirecTV and Dish are chosen at the DMA (as opposed to national) level, and can adjust across integration scenarios (see Appendix C.4 for implementation details).

In Appendix Table A.11, we report market outcomes averaged across all RSNs from these additional simulations. When satellite prices are allowed adjust, they fall on average by approximately 1.0% when RSNs are integrated and PARs are not in effect; compared to the predicted changes when satellite prices are held fixed (Table 5), the negative impact on satellite market shares and surplus is slightly mitigated, as is the increase in negotiated affiliate fees (e.g., when moving from non-integration to VI without PARs, affiliate fees to rivals increase by 16.5% on average as opposed

[85] For estimation, we restrict $\mu = 0.99$ and $\zeta^I = 1/(1+\mu)$ (see previous footnote).

to by 17.1% when satellite prices are held fixed). Nevertheless, none of the predicted levels or changes are statistically different from the case in which satellite prices are held fixed. In addition, our main findings also do not change.

7 Concluding Remarks

In this paper, we have developed a framework for the analysis of vertical integration and mergers, and applied it to examine the welfare effects of—and regulatory policy regarding—vertical integration of high value sports content in the U.S. cable and satellite television industry. The framework accounts for consumer viewership and subscription decisions, distributor pricing and carriage decisions, and channel-distributor bargaining over affiliate fees. Most importantly, it allows for vertical integration to reduce double marginalization and increase carriage as well as result in foreclosure of rivals from integrated content or raise their costs of carriage. We also allow for imperfect internalization of incentives across integrated divisions within a firm.

Our main results are as follows: (i) vertical integration leads to welfare gains when program access rules are effectively enforced; (ii) failure to effectively enforce program access rules for integrated RSNs leads to consumer and total welfare losses; (iii) in the absence of program access rules, predicted efficiency effects of vertical integration outweigh foreclosure effects on average, resulting in net consumer and total welfare increases compared to non-integration; (iv) welfare gains from vertical integration in the absence of program access rules appear to be largely absent in cases in which exclusion of rival distributors occurs, but positive when rivals continue to have access to the RSN; and (v) rival distributors are harmed when an RSN becomes integrated.

As we have noted previously, our analysis is partial and can be extended in a number of directions. First, our model has focused on comparing the efficiency effects of vertical integration to potential foreclosure of downstream distributors by integrated channels, and does not examine the foreclosure of "upstream" rival channels by an integrated distributor.[86] Second, investment effects—both on the part of content providers and distributors in channel, programming, and distribution service quality—may change upon integration (Grossman and Hart, 1986; Bolton and Whinston, 1991; Hart, 1995), and are absent from the current study. As noted in the introduction, the impact of such investment effects on welfare is ambiguous, and is the subject of future work. Our estimates and counterfactual exercises also relied on a number of modeling assumptions regarding bargaining, the form of affiliate fee pricing, and the effects of program access rule enforcement that could usefully be further examined. Finally, incorporating additional responses to vertical integration, examining how predictions might be impacted by weakened information sharing or misalignment of incentives within the firm, and documenting and measuring the strength of these vertical integration effects in other industries remain promising areas for future research.

[86] See, e.g., Waterman and Weiss (1996) who provide reduced form evidence that integration reduces carriage of rival channels. This finding could be due to foreclosure, but could also arise simply because the increased carriage of the integrated channel makes carriage of the rival channel less attractive. Our model does include the possibility of the latter effect, but does not incorporate any mechanism that might cause foreclosure of rival channels, such as an impact on the integrated channel's advertising revenues.

References

Ackerberg, Daniel A. (2009). 'A New Use of Importance Sampling to Reduce Computational Burden in Simulation Estimation', *Quantitative Marketing and Economics* 7(4), 343–376.

Asker, John. (2016). 'Diagnosing Foreclosure due to Exclusive Dealing', *Journal of Industrial Economics* 64(3), 375–410.

Atalay, Enghin, Hortaçsu, Ali, Li, Mary Jialin and Syverson, Chad. (2017), How Wide is the Firm Border? University of Chicago Working Paper.

Atalay, Enghin, Hortaçsu, Ali and Syverson, Chad. (2014). 'Vertical Integration and Input Flows', *American Economic Review* 104(4), 1120–1148.

Azar, Jose, Schmalz, Martin C. and Tecu, Isabel. (2016), Anti-Competitive Effects of Common Ownership. Unpublished.

Berry, Steven, Levinsohn, James and Pakes, Ariel. (1995). 'Automobile Prices in Market Equilibrium', *Econometrica* 63(4), 841–890.

Bolton, Patrick and Whinston, Michael D. (1991). 'The "Foreclosure" Effects of Vertical Mergers', *Journal of Institutional and Theoretical Economics* 147, 207–226.

Bresnahan, Timothy F. and Salop, Steven C. (1986). 'Quantifying the Competitive Effects of Production Joint Ventures', *International Journal of Industrial Organization* 4, 155–175.

Bresnahan, Timothy and Levin, Jonathan. (2013), Vertical Integration and Market Structure, *in* **Robert Gibbons and John Roberts**., eds, 'Handbook of Organizational Economics', Princeton University Press, Princeton, NJ.

Caves, Kevin W., Holt, Chris C. and Singer, Hal J. (2013). 'Vertical Integration in Multichannel Television Markets: A Study of Regional Sports Networks', *Review of Network Economics* 12(1), 61–92.

Chen, Dong and Waterman, David. (2007). 'Vertical Ownership, Program Network Carriage, and Tier Positioning in Cable Television: An Empirical Study', *Review of Industrial Organization* 30(3), 227–251.

Chen, Yongmin. (2001). 'On vertical mergers and their competitive effects', *RAND Journal of Economics* 32(4), 667–685.

Chipty, Tasneem. (2001). 'Vertical Integration, Market Foreclosure, and Consumer Welfare in the Cable Television Industry', *American Economic Review* 91(3), 428–453.

Ciliberto, Federico. (2006). 'Does Organizational Form Affect Investment Decisions?', *Journal of Industrial Economics* 54(1), 63–93.

Collard-Wexler, Allan, Gowrisankaran, Gautam and Lee, Robin S. (2017). '"Nash-in-Nash" Bargaining: A Microfoundation for Applied Work', forthcoming in *Journal of Political Economy* .

Conlon, Christopher T. and Mortimer, Julie H. (2015), All Units Discount: Experimental Evidence from the Vending Industry. Unpublished.

Crawford, Gregory S. and Yurukoglu, Ali. (2012). 'The Welfare Effects of Bundling in Multichannel Television Markets', *American Economic Review* 102(2), 643–685.

Draganska, Michaela, Klapper, Daniel and Villas-Boas, Sofia B. (2010). 'A Larger Slice or a Larger Pie? An Empirical Investigation of Bargaining Power in the Distribution Channel', *Marketing Science* 29(1), 57–74.

Dubin, Jeffrey A. and McFadden, Daniel L. (1984). 'An Econometric Analysis of Residential Electric Appliance Holdings and Consumption', *Econometrica* 52(2), 345–362.

FCC. (2012), Report and Order in MB Docket Nos. 12-68, 07-18, 05-192; Further Notice of Proposed Rulemaking in MB Docket No. 12-68; Order on Reconsideration in MB Docket No. 07-29, Technical report. FCC 12-123, released October 5, 2012.

FCC. (2013), Fifteenth Report: Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming, Technical report. FCC 13-99, released July 22, 2013.

Goolsbee, Austan and Petrin, Amil. (2004). 'Consumer Gains from Direct Broadcast Satellites and the Competition with Cable TV', *Econometrica* 72(2), 351–81.

Gouriéroux, Christian and Monfort, Alain. (1996), *Simulation-Based Econometric Methods*, Oxford University Press, Oxford.

Gowrisankaran, Gautam, Nevo, Aviv and Town, Robert. (2015). 'Mergers When Prices Are Negotiated: Evidence from the Hospital Industry', *American Economic Review* 105(1), 172–203.

Grennan, Matthew. (2013). 'Price Discrimination and Bargaining: Empirical Evidence from Medical Devices', *American Economic Review* 103(1), 147–177.

Grossman, S. and Hart, O. (1986). 'The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration', *Journal of Political Economy* 94, 691–796.

Hanemann, W. Michael. (1984). 'Discrete/Continuous Models of Consumer Demand', *Econometrica* 52(3), 541–561.

Hart, Oliver. (1995), *Firms, Contracts, and Financial Structure*, Oxford University Press, New York.

Hart, Oliver and Tirole, Jean. (1990). 'Vertical Integration and Market Foreclosure', *Brookings Papers on Economic Activity. Microeconomics* 1990, 205–286.

Hastings, Justine S. (2004). 'Vertical Relationships and Competition in Retail Gasoline Markets: Empirical Evidence from Contract Changes in Southern California', *American Economic Review* 94, 317–328.

Hastings, Justine S. and Gilbert, Richard J. (2005). 'Market Power, Vertical Integration and the Wholesale Price of Gasoline', *Journal of Industrial Economics* 53(4), 469–492.

Ho, Kate and Lee, Robin S. (2017). 'Insurer Competition in Health Care Markets', *Econometrica* 85(2), 379–417.

Horn, Hendrick and Wolinsky, Asher. (1988). 'Bilateral Monopoly and Incentives for Merger', *The RAND Journal of Economics* 19, 408–419.

Hortaçsu, Ali and Syverson, Chad. (2007). 'Cementing Relationships: Vertical Integration, Foreclosure, Productivity and Prices', *Journal of Political Economy* 115(2), 250–301.

Houde, Jean-Francois. (2012). 'Spatial Differentiation and Vertical Mergers in Retail Markets for Gasoline', *American Economic Review* 102(5), 2147–2182.

Krattenmaker, Thomas G. and Salop, Steven C. (1986). 'Anticompetitive Exclusion: Raising Rivals' Costs to Achieve Power over Price', *The Yale Law Journal* 2, 209–293.

Lee, Robin S. (2013). 'Vertical Integration and Exclusivity in Platform and Two-Sided Markets', *American Economic Review* 103(7), 2960–3000.

Michel, Christian. (2013), Identification and Estimation of Intra-Firm and Industry Competition via Ownership Change. Unpublished.

Mortimer, Julie H. (2008). 'Vertical Contracts in the Video Rental Industry', *Review of Economic Studies* 75, 165–199.

Nocke, Volker and White, Lucy. (2007). 'Do Vertical Mergers Facilitate Upstream Collusion', *American Economic Review* 97(4), 1321–1339.

O'Brien, Daniel P. and Salop, Steven C. (2000). 'Competitive Effects of Partial Ownership: Financial Interest and Corporate Control', *Antitrust Law Journal* 67, 559–614.

Ordover, J., Saloner, G. and Salop, S. (1990). 'Equilibrium Vertical Foreclosure', *American Economic Review* 80, 127–142.

Perry, Martin K. (1990), Vertical Integration: Determinants and Effects, *in* **Richard Schmalensee and Robert Willig**., eds, 'Handbook of Industrial Organization', Vol. 1, North Holland, Amsterdam.

Rey, Patrick and Tirole, Jean. (2007), A Primer on Foreclosure, *in* **Mark Armstrong and Rob Porter**., eds, 'Handbook of Industrial Organization', Vol. 3, North-Holland Press, Amsterdam.

Riordan, Michael H. (2008), Competitive Effects of Vertical Integration, *in* **Paolo Buccirossi**., ed., 'Handbook of Antitrust Economics', MIT Press, Cambridge, MA.

Rogerson, William P. (2014), Vertical Mergers in the Video Programming and Distribution Industry: The Case of Comcast-NBCU, *in* **Jr. John E. Kwoka and Lawrence J. White**., eds, 'The Antitrust Revolution, 6th Edition', Oxford University Press, New York.

Rubinstein, Ariel. (1982). 'Perfect Equilibrium in a Bargaining Model', *Econometrica* pp. 97–109.

Salop, Steven C. and Scheffman, David T. (1983). 'Raising Rivals' Costs', *American Economic Review* 73(2), 267–271.

Shepard, Andrea. (1993). 'Contractual Form, Retail Price, and Asset Characteristics in Gasoline Retailing', *RAND Journal of Economics* 24(1), 58–77.

Spengler, Joseph J. (1950). 'Vertical integration and antitrust policy', *The Journal of Political Economy* pp. 347–352.

Suzuki, Ayako. (2009). 'Market foreclosure and vertical merger: A case study of the vertical merger between Turner Broadcasting and Time Warner', *International Journal of Industrial Organization* 27(4), 523–543.

Villas-Boas, Sofia B. (2007). 'Vertical Relationships between Manufacturers and Retailers: Inference with Limited Data', *Review of Economic Studies* 74(2), 625–652.

Waterman, David and Weiss, Andrew A. (1996). 'The Effects of Vertical Integration between Cable Television Systems and Pay Cable Networks', *Journal of Econometrics* 72(1-2), 357–95.

Willamson, Oliver. (1985), *The Economic Institutions of Capitalism*, New York, NY.

A Appendix Tables

Table A.1: Sample Statistics - Prices, Market Shares, and Channels

		Unweighted				Weighted by HHs			
	# Obs	Mean	StdDev	Min	Max	Mean	StdDev	Min	Max
Total Markets	6,928	6,928							
Average Households (millions)	6,928					39.7			
Cable									
Year	6,928	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,928	$50.67	$10.31	$8.67	$130.96	$52.20	$8.86	$8.67	$130.96
Market Share	6,928	0.628	0.162	0.001	0.965	0.639	0.135	0.001	0.965
Cable Networks	6,928	67.0	18.1	0	101	72.1	14.8	0	101
RSNs	6,928	1.6	0.8	0	5	1.8	0.9	0	5
Total Channels	6,928	68.6	18.4	0	103	73.8	15.0	0	103
DirecTV									
Year	6,928	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,928	$52.76	$6.36	$46.05	$76.73	$52.66	$6.08	$46.05	$76.73
Market Share	6,928	0.090	0.060	0.002	0.499	0.091	0.063	0.002	0.499
Cable Networks	6,928	79.4	10.4	66	97	79.8	10.2	66	97
RSNs	6,928	1.9	1.0	0	7	1.9	1.0	0	7
Total Channels	6,928	84.3	10.9	69	107	84.7	10.7	69	107
Dish									
Year	6,928	2004	2.9	2000	2010	2004	2.8	2000	2010
Price	6,928	$53.43	$4.81	$44.28	$68.33	$53.47	$4.63	$44.28	$68.33
Market Share	6,928	0.062	0.054	0.000	0.472	0.058	0.052	0.000	0.472
Cable Networks	6,928	69.4	13.3	54	91	70.0	13.1	54	91
RSNs	6,928	1.8	0.9	0	6	1.7	0.8	0	6
Total Channels	6,928	73.7	13.9	56	99	74.4	13.6	56	99

Notes: Reported are the average price, market share, and number of cable networks, Regional Sport Networks (RSNs), and total channels for the local cable operators as well as the two national satellite providers serving each of our markets. Markets are defined as the set of continuous zip codes within a cable system facing the same portfolio of competitors. We exclude (the relatively few) markets facing competition between cable operators. All the data cover the years 2000-2010. To be included, we required information on each of price, market share, and channels. Cable system subscriber and channel information is from the Nielsen FOCUS dataset. Cable system price information is drawn from the Internet Archive, newspaper reports, and the TNS Bill Harvesting database. Satellite system channel and price information is drawn from the Internet Archive. Cable and satellite subscriber market shares are estimated from the MRI (2000-2007) and Simmons (2008-2010) household surveys and Nielsen FOCUS dataset. See the text for more details.

Table A.2: National Cable Channels: Affiliate Fees and Viewership

	Affiliate Fees					Viewership					
	Kagan					Nielsen Ratings		Combined MRI / Simmons			
	Years	Mean	StDev	Min	Max	Obs	Mean	Obs	Mean	SDev	Frac > 0
ABC Family Channel	11	$0.19	$0.02	$0.16	$0.22	747	0.418	277,535	0.344	1.149	0.176
AMC	11	$0.22	$0.02	$0.20	$0.25	747	0.491	277,535	0.351	1.183	0.156
Animal Planet	11	$0.07	$0.01	$0.06	$0.09	747	0.275	277,535	0.344	1.108	0.203
A&E	11	$0.21	$0.03	$0.16	$0.26	747	0.664	277,535	0.472	1.373	0.230
BET	11	$0.14	$0.02	$0.11	$0.17	747	0.382	277,535	0.184	1.017	0.070
Bravo	11	$0.15	$0.03	$0.11	$0.20	747	0.277	277,535	0.169	0.804	0.092
Cartoon Network	11	$0.14	$0.03	$0.08	$0.18	747	0.989	277,535	0.231	1.098	0.106
CMT	11	$0.06	$0.02	$0.01	$0.08	747	0.142	277,535	0.120	0.732	0.067
CNBC	11	$0.24	$0.04	$0.16	$0.30	747	0.217	277,535	0.313	1.185	0.170
CNN	11	$0.43	$0.05	$0.35	$0.52	747	0.550	277,535	0.701	1.744	0.319
Comedy Central	11	$0.11	$0.02	$0.08	$0.14	747	0.449	277,535	0.280	0.997	0.162
Discovery Channel	11	$0.27	$0.04	$0.22	$0.35	747	0.535	277,535	0.628	1.462	0.327
Disney Channel	11	$0.81	$0.06	$0.75	$0.91	747	1.171	277,535	0.246	1.074	0.116
E! Entertainment TV	11	$0.19	$0.02	$0.15	$0.21	747	0.315	277,535	0.201	0.788	0.137
ESPN	11	$2.81	$1.12	$1.14	$4.34	747	0.836	277,535	0.675	1.767	0.257
ESPN 2	11	$0.37	$0.14	$0.17	$0.58	747	0.262	277,535	0.334	1.220	0.151
ESPN Classic Sports	11	$0.14	$0.03	$0.10	$0.18	636	0.037	277,535	0.072	0.521	0.047
Food Network	11	$0.06	$0.03	$0.03	$0.14	747	0.411	277,535	0.396	1.364	0.175
Fox News Channel	11	$0.32	$0.18	$0.17	$0.70	747	0.785	277,535	0.697	1.961	0.267
FX	11	$0.34	$0.06	$0.27	$0.43	747	0.463	277,535	0.258	0.976	0.137
Golf Channel	11	$0.20	$0.05	$0.13	$0.26	580	0.065	277,535	0.084	0.633	0.041
Hallmark Channel	11	$0.04	$0.02	$0.01	$0.06	699	0.307	225,618	0.301	1.268	0.088
Headline News	—	—	—	—	—	747	0.214	277,535	0.278	0.983	0.173
HGTV	11	$0.08	$0.04	$0.03	$0.14	747	0.500	277,535	0.397	1.446	0.162
History Channel	11	$0.18	$0.04	$0.13	$0.23	747	0.531	277,535	0.531	1.462	0.251
Lifetime	11	$0.21	$0.06	$0.13	$0.29	747	0.679	277,535	0.554	1.650	0.199
MSNBC	11	$0.14	$0.02	$0.12	$0.17	747	0.343	277,535	0.330	1.181	0.182
MTV	11	$0.27	$0.05	$0.20	$0.35	747	0.568	277,535	0.235	0.983	0.127
Nickelodeon	11	$0.37	$0.05	$0.29	$0.47	747	1.555	277,535	0.200	0.991	0.096
SyFy	11	$0.17	$0.04	$0.12	$0.22	747	0.427	277,535	0.301	1.207	0.126
TBS	11	$0.37	$0.12	$0.19	$0.54	747	0.905	277,535	0.497	1.345	0.243
TLC	11	$0.16	$0.01	$0.14	$0.17	747	0.422	277,535	0.342	1.151	0.173
truTV	11	$0.09	$0.01	$0.08	$0.10	747	0.384	277,535	0.233	1.081	0.101
Turner Classic Movies	11	$0.22	$0.03	$0.16	$0.27	580	0.286	277,535	0.268	1.142	0.105
TNT	11	$0.83	$0.16	$0.55	$1.10	747	1.219	277,535	0.592	1.553	0.263
USA	11	$0.46	$0.07	$0.36	$0.57	747	1.081	277,535	0.503	1.442	0.230
VH1	11	$0.12	$0.02	$0.09	$0.16	747	0.336	277,535	0.151	0.717	0.101
Weather Channel	11	$0.10	$0.01	$0.08	$0.12	747	0.234	277,535	0.380	1.046	0.326

Notes: Reported are average affiliate fees and viewership of the 38 non-RSN cable television networks included in our demand system. The averages are over the years 2000-2010 for SNL Kagan affiliate fees, over DMA-years for the Nielsen (DMA-level) viewership data, and over households and years for the MRI (2000-2007) and Simmons (2008-2010) household-level viewership data. Affiliate fees are the monthly per subscriber fees paid by cable and satellite distributors to television networks for the right to distribute the network's programming to subscribers. The Nielsen "rating" is the percentage of US households watching a given program on a given channel at a given time. We average program-level ratings across programs within a channel-DMA-year, and report the across-DMA-year average here. MRI/Simmons viewership is reported as the average number of hours watching that channel in a typical week. It is converted to a Nielsen-equivalent "rating" by dividing by the number of hours in a week and rescaling it to lie between 0 and 100. The average fraction of households viewing a channel at all ("Frac > 0") is the average percentage of households that reported positive viewing of a channel in a typical week.

Table A.3: Regional Sports Networks: Availability, Affiliate Fees, and Viewership

	Kagan Availability		Kagan Affiliate Fees					Nielsen Viewing				
	Systems Served	HH Served	Years	Mean	StDev	Min	Max	# Obs	All HH	Has Cable	Has DTV	Has Dish
Comcast RSNs												
CSN Bay Area	137	4.7	11	$1.70	$0.53	$1.01	$2.52	720	0.41	0.48	0.45	0.33
CSN California	135	10.0	7	$0.91	$0.14	$0.75	$1.10	360	0.22	0.26	0.20	0.22
CSN Chicago	335	5.7	7	$2.02	$0.18	$1.90	$2.37	360	0.54	0.66	0.59	0.36
CSN Mid-Atlantic	194	6.2	11	$2.03	$0.74	$0.85	$3.10	1,440	0.13	0.17	0.09	0.03
CSN New England	222	4.8	11	$1.26	$0.32	$0.90	$1.89	1,080	0.27	0.29	0.30	0.17
CSN Philadelphia	102	4.6	11	$1.94	$0.61	$1.05	$2.85	360	0.91	1.15	0.06	0.05
News Corp RSNs												
Fox Sports Detroit	284	5.3	11	$1.75	$0.45	$1.05	$2.34	360	1.02	1.25	0.94	0.68
Fox Sports Florida	152	6.7	11	$1.34	$0.33	$0.90	$1.95	2,160	0.14	0.16	0.12	0.12
Fox Sports Midwest	695	7.4	11	$1.42	$0.44	$0.57	$2.01	1,800	0.31	0.40	0.31	0.26
Fox Sports North	620	4.5	11	$1.97	$0.60	$1.15	$2.88	720	0.79	1.01	1.04	0.70
Fox Sports Ohio	306	7.0	11	$1.61	$0.49	$0.75	$2.42	2,160	0.34	0.42	0.31	0.29
Fox Sports South	905	15.3	11	$1.40	$0.52	$0.52	$2.17	2,880	0.14	0.19	0.09	0.08
Fox Sports Southwest	924	12.7	11	$1.68	$0.50	$0.80	$2.43	4,320	0.16	0.21	0.17	0.13
Fox Sports West	167	9.2	11	$1.80	$0.44	$0.87	$2.35	1,080	0.16	0.21	0.12	0.07
Prime Ticket (New)	132	8.2	11	$1.52	$0.46	$0.60	$2.07	720	0.16	0.22	0.12	0.09
Sun Sports	234	8.3	11	$1.36	$0.54	$0.55	$2.27	1,440	0.18	0.00	0.11	0.09
Liberty RSNs												
Root Sports Northwest	281	5.4	11	$1.73	$0.52	$0.70	$2.54	256	0.23	0.30	0.19	0.15
Root Sports Pittsburgh	316	4.5	11	$1.81	$0.53	$1.05	$2.55	512	0.06	0.07	0.06	0.03
Root Sports Rocky Mountain	479	5.4	11	$1.58	$0.42	$0.75	$2.06	384	0.08	0.10	0.10	0.13
Cablevision RSNs												
Madison Square Garden Network (MSG)	219	9.9	11	$1.82	$0.30	$1.45	$2.44	1,080	0.23	0.07	0.24	0.17
MSG Plus	165	7.5	11	$1.24	$0.15	$1.01	$1.61	360	0.07	0.27	0.05	0.06
Cox RSNs												
Channel 4 San Diego	15	1.0	11	$0.87	$0.26	$0.53	$1.32	360	0.48	0.60	0.03	0.00
Time Warner RSNs												
SportsNet New York	314	20.1	5	$1.91	$0.18	$1.71	$2.20	1,080	0.13	0.15	0.13	0.09
Independent/Other RSNs												
Altitude Sports & Entertainment	130	2.8	7	$1.99	$0.29	$1.70	$2.47	360	0.24	0.30	0.21	0.22
Mid-Atlantic Sports Network (MASN)	109	5.2	6	$1.58	$0.12	$1.45	$1.77	1,800	0.11	0.13	0.08	0.11
New England Sports Network (NESN)	213	4.5	11	$1.99	$0.49	$1.30	$2.72	1,080	0.95	1.02	1.00	0.48

Notes: Reported are the average availability, affiliate fees, and viewing of the 26 Regional Sports Networks (RSNs) active in 2007 that we focus on in our analysis. "Systems served" is the number of systems carrying the RSN, and "HH served" is the number of households to which the RSN is available. Affiliate fees are the monthly per subscriber fees paid by cable and satellite distributors to television networks for the right to distribute the network's programming to subscribers. Availability and affiliate fee information is provided by SNL Kagan. RSN viewership is provided by Nielsen. For availability and affiliate fees, the average is over the years 2000-2010, and for viewing the average is over DMA-years between 2007-2011 among the top 56 DMAs for which the RSN is deemed to be "relevant" (which occurs if at least 30 percent of the teams carried by that RSN are not "blacked out"; see text for further details). Nielsen viewing is the average"rating," the percentage of US households watching a given program on a given channel at a given time, reported for all US households as well as for those households that subscribe to cable or to the two national satellite providers, DirecTV (DTV) and Dish.

Table A.4: Estimates of Additional Viewership Parameters and Channel WTPs

	Viewership Parameters				WTP	
	ρ_c^1		ρ_c^0		Mean	
National Channels	Est	SE	Est	SE	All	> 0
ABC Family Channel	1.85	0.06	0.33	0.01	0.54	1.15
AMC	2.16	0.10	0.31	0.02	0.63	1.85
Animal Planet	1.53	0.05	0.41	0.02	0.31	0.53
Arts Entertainment AE	2.29	0.08	0.37	0.02	0.81	1.74
BET	2.68	0.28	0.13	0.02	0.38	1.83
Bravo	1.92	0.09	0.21	0.01	0.37	1.25
Cartoon Network	2.96	0.23	0.24	0.02	0.82	2.19
CMT	1.69	0.17	0.15	0.02	0.18	1.31
CNBC	1.51	0.06	0.38	0.02	0.41	1.18
CNN	2.05	0.05	0.58	0.02	0.96	1.43
Comedy Central	2.17	0.12	0.28	0.02	0.54	1.41
Discovery Channel	1.80	0.04	0.60	0.02	0.94	1.33
Disney Channel	2.94	0.16	0.24	0.02	0.89	2.64
E Entertainment TV	1.58	0.05	0.33	0.01	0.37	1.28
ESPN	11.06	0.56	0.29	0.01	7.66	16.41
ESPN 2	5.45	0.45	0.26	0.01	1.63	3.57
ESPN Classic	1.26	0.76	0.08	0.02	0.65	2.21
Food Network	1.83	0.05	0.42	0.02	0.68	1.16
Fox News Channel	2.36	0.09	0.49	0.02	1.14	1.98
FX	2.08	0.09	0.28	0.01	0.52	1.42
Golf Channel	2.30	0.84	0.05	0.02	0.09	0.46
Hallmark Channel	3.59	0.86	0.15	0.02	0.45	1.92
Headline News	1.51	0.05	0.35	0.01	0.37	0.96
HGTV	2.41	0.10	0.29	0.01	0.73	1.50
History Channel	2.25	0.09	0.42	0.02	0.83	1.18
Lifetime	2.61	0.11	0.34	0.02	0.92	2.01
MSNBC	1.69	0.06	0.39	0.02	0.52	1.23
MTV	2.19	0.11	0.25	0.02	0.52	1.38
Nickelodeon	4.74	0.41	0.16	0.01	1.07	3.06
SyFy, Sci-Fi	2.19	0.11	0.24	0.02	0.54	1.56
TBS	2.16	0.06	0.49	0.02	0.99	1.88
TLC	2.23	0.12	0.29	0.02	0.58	1.79
truTV, Court TV	2.56	0.21	0.21	0.01	0.46	1.91
Turner Classic Movies	3.58	0.86	0.12	0.02	0.48	1.54
TNT	2.34	0.07	0.53	0.02	1.36	2.14
USA	2.36	0.07	0.42	0.02	1.07	1.82
VH1	2.31	0.22	0.14	0.02	0.34	0.82
Weather Channel	1.38	0.04	0.54	0.02	0.48	0.79

	Viewership Parameters				WTP		
	ρ_c^1		ρ_c^0		Mean		
RSNs	Est	SE	Est	SE	All	SE	> 0
Altitude Sports	13.97	1.83	0.14	0.01	3.22	0.39	5.76
4SD	0.81	0.53	0.66	0.08	1.54	0.03	1.77
CSN Bay Area	6.68	0.50	0.24	0.01	4.16	0.19	7.40
CSN CA	6.55	6.61	0.05	0.08	1.04	0.09	6.84
CSN Chicago	7.92	0.53	0.19	0.01	3.44	0.22	6.75
CSN Mid-Atl	8.64	0.82	0.16	0.01	3.27	0.21	6.22
CSN NE	2.99	0.97	0.28	0.02	1.47	0.08	5.61
CSN Phil	7.41	0.92	0.26	0.01	4.99	0.21	17.63
FS Detroit	9.88	0.51	0.16	0.00	4.38	0.24	11.28
FS Florida	8.21	1.65	0.22	0.01	2.59	0.24	11.85
FS Midwest	12.13	2.05	0.15	0.01	2.44	0.32	16.19
FS North	15.01	2.18	0.17	0.01	4.50	0.40	21.31
FS Ohio	8.61	1.01	0.23	0.01	3.70	0.25	6.87
FS South	10.03	1.34	0.10	0.00	1.63	0.21	3.92
FS Southwest	10.52	1.37	0.18	0.01	3.07	0.31	16.83
FS West	6.07	0.52	0.22	0.01	4.06	0.18	8.16
MSG Plus	4.49	0.63	0.16	0.01	1.66	0.11	10.97
MSG	7.29	0.62	0.19	0.01	2.32	0.19	4.75
MASN	10.09	1.70	0.16	0.01	2.21	0.27	13.11
NESN	7.58	0.45	0.32	0.01	6.91	0.24	20.12
Prime Ticket	5.36	0.33	0.20	0.01	3.11	0.13	5.37
Root NW	6.25	1.15	0.23	0.02	1.79	0.20	7.88
Root Pitts	4.81	0.73	0.19	0.01	2.17	0.12	11.70
Root Rocky Mth	7.16	1.81	0.17	0.03	1.79	0.20	10.67
SNY	5.74	0.61	0.16	0.02	2.51	0.14	5.11
Sun Sports	8.53	1.94	0.12	0.01	1.65	0.18	11.09

Notes: This table reports estimated viewership parameters $\boldsymbol{\rho}$ and implied willingness-to-pay (WTP) amounts (in dollars per household per month) for the national channels and RSNs in our analysis. Parameter ρ_c^0 is the probability that a household has positive marginal utilty from channel c, and parameter ρ_c is the exponential parameter governing the distribution of marginal utility if positive. Mean WTP amounts are computed for all households ("All"), and for households conditional on deriving positive utility from the channel ("> 0"). Asymptotic GMM standard errors are computed using numerical derivatives and 1500 bootstrap draws of markets to estimate the variance-covariance matrix of the moments.

Table A.5: Simulated Market Outcomes for RSNs (1/6)

		(i) No VI	(ii) VI PARs (vs. No VI)		(iii) VI No PARs (vs. No VI)	
		Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
CABLE OWNED RSNs (1/2)						
4SD	Cable Mkt Share	0.74	0.1%		1.4%	
Cox		[0.66,0.77]	[-0.7%,3.3%]		[-0.1%,7.9%]	
Pop 2.81M	Sat Mkt Share	0.16	0.0%		-5.6%	
Footprint 100%		[0.15,0.19]	[-3.6%,2.6%]		[-13.4%,0.5%]	
WTP $1.54	Cable Carriage	0.49	0.0%		0.0%	
		[0.49,0.49]	[0.0%,105.5%]		[0.0%,105.5%]	
	Cable Prices	51.05	0.0%		-0.2%	
		[50.00,55.39]	[-2.3%,0.4%]		[-4.5%,0.6%]	
Foreclose: 69%	Aff Fees to Sat	0.78	1.2%		-	
		[-0.07,1.45]	[-13.4%,18.9%]		-	
	Cable + RSN Surplus	28.87	0.0%	0.1%	0.3%	5.9%
		[16.84,34.38]	[0.0%,2.2%]	[0.0%,87.9%]	[0.0%,3.1%]	[1.3%,93.5%]
	Satellite Surplus	3.71	-0.1%	-0.2%	-2.3%	-5.4%
		[1.08,4.37]	[-3.9%,2.5%]	[-12.5%,14.6%]	[-11.2%,0.0%]	[-27.9%,0.0%]
	Consumer Welfare	34.43	0.0%	0.7%	-0.4%	-8.3%
		[18.90,38.61]	[-0.3%,2.1%]	[-18.9%,72.8%]	[-1.8%,5.0%]	[-32.8%,112.3%]
	Total Welfare	67.01	0.0%	0.6%	-0.2%	-7.8%
		[34.21,73.77]	[-0.1%,1.6%]	[-5.2%,148.2%]	[-0.7%,2.3%]	[-27.1%,165.7%]
CSN BAY AREA	Cable Mkt Share	0.61	2.3%		2.2%	
Comcast		[0.57,0.65]	[0.8%,7.5%]		[0.8%,7.5%]	
Pop 6.03M	Sat Mkt Share	0.22	-1.9%		-1.8%	
Footprint 54%		[0.21,0.24]	[-7.3%,-0.8%]		[-7.3%,-0.7%]	
WTP $4.16	Cable Carriage	0.57	0.0%		0.0%	
		[0.48,0.62]	[-8.1%,9.8%]		[-8.1%,9.8%]	
	Cable Prices	55.64	-1.7%		-1.7%	
		[53.77,58.92]	[-4.6%,-0.2%]		[-4.6%,-0.2%]	
Foreclose: 0%	Aff Fees to Sat	1.69	0.5%		17.7%	
		[0.76,2.01]	[-3.8%,9.3%]		[8.6%,32.7%]	
	Cable + RSN Surplus	23.96	0.1%	0.4%	0.3%	1.9%
		[13.04,26.89]	[-0.4%,0.5%]	[-3.6%,2.8%]	[-0.2%,0.8%]	[-1.6%,4.4%]
	Satellite Surplus	5.62	-2.0%	-2.7%	-3.1%	-4.2%
		[1.69,6.16]	[-8.2%,-0.9%]	[-10.8%,-1.5%]	[-9.5%,-1.6%]	[-12.8%,-2.9%]
	Consumer Welfare	33.25	1.3%	10.6%	1.3%	10.5%
		[17.78,37.30]	[0.5%,4.4%]	[4.4%,37.6%]	[0.5%,4.4%]	[4.1%,37.5%]
	Total Welfare	62.83	0.5%	8.3%	0.5%	8.2%
		[29.93,68.46]	[0.0%,1.8%]	[1.3%,30.6%]	[0.0%,1.8%]	[1.2%,30.6%]
CSN CA	Cable Mkt Share	0.61	0.4%		0.4%	
Comcast		[0.55,0.65]	[-4.8%,4.8%]		[-4.8%,4.8%]	
Pop 3.86M	Sat Mkt Share	0.26	-0.2%		-0.2%	
Footprint 10%		[0.23,0.29]	[-3.5%,6.4%]		[-3.5%,6.4%]	
WTP $1.04	Cable Carriage	0.36	0.0%		0.0%	
		[0.32,0.36]	[0.0%,64.4%]		[0.0%,64.4%]	
	Cable Prices	53.88	-0.2%		-0.2%	
		[51.89,57.25]	[-3.0%,3.3%]		[-3.0%,3.4%]	
Foreclose: 0%	Aff Fees to Sat	0.14	0.2%		5.9%	
		[-0.08,0.61]	[-26.0%,15.1%]		[-8.4%,45.7%]	
	Cable + RSN Surplus	23.13	0.0%	-0.1%	0.0%	0.1%
		[12.36,26.22]	[0.0%,0.4%]	[-0.2%,14.8%]	[0.0%,0.5%]	[0.0%,16.9%]
	Satellite Surplus	6.32	-0.2%	-1.1%	-0.2%	-1.3%
		[1.92,6.81]	[-3.6%,6.7%]	[-44.3%,24.5%]	[-3.8%,6.6%]	[-46.3%,24.1%]
	Consumer Welfare	35.17	0.2%	6.6%	0.2%	6.6%
		[18.63,39.77]	[-2.2%,2.2%]	[-54.6%,135.7%]	[-2.2%,2.2%]	[-54.7%,135.7%]
	Total Welfare	64.62	0.1%	5.4%	0.1%	5.4%
		[30.68,71.11]	[-0.6%,1.0%]	[-26.1%,109.5%]	[-0.6%,1.0%]	[-26.1%,109.4%]
CSN CHICAGO	Cable Mkt Share	0.58	1.2%		0.8%	
Comcast		[0.57,0.62]	[-0.1%,1.5%]		[-0.1%,1.4%]	
Pop 9.62M	Sat Mkt Share	0.23	-0.8%		-0.6%	
Footprint 76%		[0.22,0.23]	[-1.5%,0.2%]		[-1.4%,0.2%]	
WTP $3.44	Cable Carriage	0.78	-1.3%		-1.3%	
		[0.70,0.79]	[-0.4%,19.4%]		[-0.5%,18.8%]	
	Cable Prices	58.98	-0.7%		-0.4%	
		[56.78,59.57]	[-0.8%,0.3%]		[-0.8%,0.3%]	
Foreclose: 0%	Aff Fees to Sat	1.59	0.2%		12.5%	
		[0.65,1.75]	[-6.1%,1.1%]		[4.4%,19.4%]	
	Cable + RSN Surplus	22.55	0.0%	0.0%	0.2%	1.2%
		[10.47,25.54]	[0.0%,0.8%]	[-0.2%,5.5%]	[0.1%,1.0%]	[0.9%,6.6%]
	Satellite Surplus	5.78	-0.8%	-1.4%	-1.3%	-2.2%
		[1.81,6.21]	[-1.4%,0.2%]	[-2.0%,0.3%]	[-2.4%,-0.4%]	[-3.1%,-0.9%]
	Consumer Welfare	31.69	0.6%	5.9%	0.4%	3.9%
		[16.88,35.79]	[-0.1%,1.1%]	[-0.8%,10.5%]	[-0.1%,1.0%]	[-0.9%,9.1%]
	Total Welfare	60.01	0.3%	4.5%	0.2%	2.9%
		[27.90,66.79]	[0.0%,0.7%]	[-0.7%,11.8%]	[0.0%,0.7%]	[-0.7%,11.6%]

Notes: Simulated market outcomes across three integration scenarios. See Table 4 for details.

Table A.6: Simulated Market Outcomes for RSNs (2/6)

		(i) No VI	(ii) VI PARs		(iii) VI No PARs	
			(vs. No VI)		(vs. No VI)	
		Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
CABLE OWNED RSNs (2/2)						
CSN MID-ATL	Cable Mkt Share	0.65	0.6%		0.3%	
Comcast		[0.62,0.66]	[0.1%,3.4%]		[-0.5%,3.7%]	
Pop 6.55M	Sat Mkt Share	0.18	-0.4%		-0.1%	
Footprint 70%		[0.18,0.19]	[-2.8%,0.0%]		[-9.3%,0.2%]	
Pred WTP $3.27	Cable Carriage	0.59	2.9%		5.5%	
		[0.42,0.82]	[-17.6%,67.1%]		[-26.2%,80.4%]	
	Cable Prices	55.63	-0.4%		-0.1%	
		[55.08,57.75]	[-1.7%,0.3%]		[-1.5%,1.6%]	
Foreclose: 20%	Aff Fees to Sat	1.35	3.0%		38.2%	
		[0.49,1.59]	[-10.3%,9.0%]		[13.5%,53.3%]	
	Cable + RSN Surplus	23.95	0.1%	0.8%	0.5%	3.9%
		[11.54,26.29]	[-0.3%,1.6%]	[-2.7%,11.0%]	[-0.3%,2.0%]	[-2.5%,14.0%]
	Satellite Surplus	4.53	-0.6%	-0.8%	-2.3%	-3.1%
		[1.35,5.00]	[-2.6%,0.1%]	[-4.0%,0.1%]	[-4.5%,-0.1%]	[-6.1%,-0.2%]
	Consumer Welfare	30.76	0.5%	4.5%	0.3%	2.5%
		[15.74,33.88]	[0.1%,2.4%]	[1.7%,22.8%]	[-3.1%,2.0%]	[-26.8%,20.6%]
	Total Welfare	59.24	0.2%	4.5%	0.2%	3.3%
		[27.92,65.09]	[0.2%,1.4%]	[2.8%,24.1%]	[-1.2%,1.3%]	[-19.3%,23.8%]
CSN NE	Cable Mkt Share	0.63	1.0%		1.7%	
Comcast		[0.61,0.66]	[0.0%,1.6%]		[0.1%,2.7%]	
Pop 5.2M	Sat Mkt Share	0.13	-1.1%		-5.4%	
Footprint 85%		[0.12,0.13]	[-1.8%,0.0%]		[-7.2%,-0.2%]	
WTP $1.47	Cable Carriage	0.77	12.2%		9.7%	
		[0.62,0.83]	[3.3%,33.8%]		[3.3%,35.5%]	
	Cable Prices	56.17	-0.5%		-0.4%	
		[54.37,57.34]	[-1.0%,0.2%]		[-1.3%,0.5%]	
Foreclose: 89%	Aff Fees to Sat	0.78	-4.7%		-	
		[0.20,0.91]	[-3.8%,9.6%]		-	
	Cable + RSN Surplus	26.78	0.2%	3.6%	0.6%	10.2%
		[12.90,29.35]	[0.0%,0.5%]	[1.4%,9.7%]	[0.2%,1.1%]	[4.8%,18.7%]
	Satellite Surplus	2.98	-1.0%	-2.1%	-2.4%	-4.8%
		[0.85,3.21]	[-1.8%,0.0%]	[-3.4%,-0.1%]	[-3.7%,-0.5%]	[-8.2%,-0.9%]
	Consumer Welfare	29.21	0.8%	15.0%	0.1%	2.7%
		[15.79,33.11]	[0.1%,1.3%]	[1.7%,28.7%]	[-0.9%,1.4%]	[-20.0%,31.8%]
	Total Welfare	58.97	0.4%	16.5%	0.2%	8.1%
		[28.89,64.91]	[0.1%,0.7%]	[4.5%,30.2%]	[-0.2%,0.8%]	[-6.9%,34.1%]
MSG PLUS	Cable Mkt Share	0.66	3.1%		3.1%	
Cablevision		[0.65,0.70]	[0.1%,5.1%]		[0.1%,4.9%]	
Pop 9.46M	Sat Mkt Share	0.19	-4.6%		-4.6%	
Footprint 49%		[0.17,0.19]	[-7.5%,-0.4%]		[-9.4%,-0.7%]	
WTP $1.66	Cable Carriage	0.42	54.6%		54.6%	
		[0.41,0.89]	[-0.3%,85.8%]		[-23.0%,85.8%]	
	Cable Prices	59.59	-2.2%		-2.2%	
		[57.46,61.09]	[-4.0%,0.0%]		[-3.8%,0.8%]	
Foreclose: 6%	Aff Fees to Sat	0.75	0.9%		31.1%	
		[0.32,0.89]	[-17.8%,17.0%]		[2.6%,64.0%]	
	Cable + RSN Surplus	32.81	0.6%	11.7%	0.7%	14.3%
		[15.57,36.92]	[-0.1%,0.9%]	[-2.2%,17.0%]	[-0.1%,1.3%]	[-1.4%,24.0%]
	Satellite Surplus	4.39	-4.7%	-12.3%	-5.6%	-14.8%
		[1.32,4.71]	[-7.5%,-0.3%]	[-19.7%,-0.9%]	[-7.8%,0.0%]	[-21.6%,-0.1%]
	Consumer Welfare	35.59	3.2%	67.6%	3.1%	67.2%
		[19.34,39.95]	[0.4%,4.8%]	[8.2%,110.9%]	[-1.0%,4.5%]	[-21.2%,108.9%]
	Total Welfare	72.78	1.5%	67.0%	1.5%	66.7%
		[33.33,80.75]	[0.2%,2.1%]	[10.0%,96.8%]	[-0.2%,2.0%]	[-9.4%,95.8%]
SNY	Cable Mkt Share	0.63	3.8%		3.8%	
Comcast, TWC		[0.62,0.67]	[0.5%,6.1%]		[0.5%,6.1%]	
Pop 11.7M	Sat Mkt Share	0.18	-4.5%		-4.5%	
Footprint 35%		[0.17,0.18]	[-8.2%,-0.7%]		[-8.2%,-0.7%]	
WTP $2.51	Cable Carriage	0.79	1.9%		1.9%	
		[0.75,0.89]	[-10.3%,8.3%]		[-10.3%,7.7%]	
	Cable Prices	59.80	-2.9%		-2.9%	
		[56.97,61.32]	[-4.5%,-0.3%]		[-4.5%,-0.3%]	
Foreclose: 0%	Aff Fees to Sat	1.40	-4.0%		-3.9%	
		[0.45,1.54]	[-6.2%,6.3%]		[-6.0%,6.3%]	
	Cable + RSN Surplus	30.12	0.0%	-0.6%	0.0%	-0.6%
		[14.34,33.64]	[-0.6%,0.2%]	[-9.6%,2.7%]	[-0.6%,0.2%]	[-9.6%,2.3%]
	Satellite Surplus	4.16	-4.3%	-7.2%	-4.3%	-7.2%
		[1.26,4.49]	[-8.4%,-0.7%]	[-13.8%,-1.1%]	[-8.4%,-0.7%]	[-13.8%,-1.1%]
	Consumer Welfare	33.69	3.3%	43.9%	3.3%	43.9%
		[18.22,37.96]	[0.4%,5.2%]	[5.9%,72.8%]	[0.4%,5.2%]	[5.9%,72.8%]
	Total Welfare	67.96	1.3%	36.1%	1.3%	36.1%
		[31.47,75.26]	[0.2%,2.0%]	[4.2%,58.3%]	[0.2%,2.0%]	[4.2%,58.3%]

Notes: Simulated market outcomes across three integration scenarios. See Table 4 for details.

Table A.7: Simulated Market Outcomes for RSNs (3/6)

		(i) No VI	(ii) VI PARs (vs. No VI)		(iii) VI No PARs (vs. No VI)	
		Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
SATELLITE OWNED RSNs						
ROOT NW	Cable Mkt Share	0.61	0.7%		0.6%	
DirecTV		[0.58,0.62]	[-0.4%,2.8%]		[-0.6%,2.6%]	
Pop 4.15M	Sat Mkt Share	0.23	-0.5%		-0.4%	
WTP $1.79		[0.22,0.23]	[-2.3%,0.4%]		[-2.1%,1.1%]	
	Cable Carriage	0.78	0.0%		0.0%	
		[0.52,1.00]	[-13.4%,14.2%]		[-31.3%,4.9%]	
	Cable Prices	52.90	-0.4%		-0.4%	
		[51.94,54.61]	[-1.9%,0.3%]		[-2.0%,0.4%]	
Foreclose: 0%	Aff Fees to Rivals	0.75	1.1%		6.4%	
		[0.26,0.98]	[-7.8%,3.1%]		[-3.4%,11.3%]	
	Cable Surplus	21.94	0.0%	-0.3%	-0.2%	-2.4%
		[9.99,25.20]	[-0.2%,0.2%]	[-2.1%,2.2%]	[-0.6%,0.2%]	[-5.8%,2.3%]
	Satellite + RSN Surplus	6.69	-0.4%	-1.4%	0.2%	0.9%
		[2.25,7.14]	[-2.3%,1.1%]	[-7.7%,3.3%]	[-3.1%,1.0%]	[-10.9%,3.0%]
	Consumer Welfare	33.05	0.4%	7.6%	0.4%	6.7%
		[17.39,36.63]	[-0.2%,1.7%]	[-4.8%,31.3%]	[-0.9%,1.6%]	[-15.6%,28.9%]
	Total Welfare	61.68	0.2%	5.9%	0.2%	5.2%
		[29.41,67.77]	[-0.3%,0.8%]	[-9.1%,27.5%]	[-0.7%,0.7%]	[-23.7%,24.9%]
ROOT PITT	Cable Mkt Share	0.62	1.6%		1.1%	
DirecTV		[0.60,0.63]	[0.3%,2.4%]		[-0.1%,2.1%]	
Pop 5.09M	Sat Mkt Share	0.16	-1.9%		-1.2%	
WTP $2.17		[0.16,0.16]	[-2.2%,-0.2%]		[-1.8%,0.7%]	
	Cable Carriage	0.62	0.0%		-4.3%	
		[0.51,0.69]	[-22.1%,5.0%]		[-29.4%,0.0%]	
	Cable Prices	55.64	-1.2%		-1.0%	
		[54.70,56.76]	[-1.8%,-0.2%]		[-1.9%,-0.1%]	
Foreclose: 0%	Aff Fees to Rivals	1.24	-0.1%		8.4%	
		[0.53,1.51]	[-2.2%,6.2%]		[5.1%,19.7%]	
	Cable Surplus	23.54	0.0%	-0.1%	-0.3%	-3.0%
		[10.87,25.69]	[-0.4%,0.0%]	[-4.2%,0.4%]	[-0.7%,-0.1%]	[-7.2%,-1.1%]
	Satellite + RSN Surplus	5.04	-1.4%	-3.3%	-0.1%	-0.1%
		[1.51,5.39]	[-4.5%,0.0%]	[-9.4%,0.1%]	[-5.1%,1.0%]	[-8.4%,2.3%]
	Consumer Welfare	28.01	1.1%	14.5%	0.8%	10.7%
		[14.67,31.16]	[0.2%,1.8%]	[2.5%,25.4%]	[-0.1%,1.6%]	[-1.0%,22.2%]
	Total Welfare	56.59	0.4%	11.1%	0.3%	7.6%
		[27.15,61.63]	[-0.2%,0.6%]	[-4.5%,16.5%]	[-0.4%,0.5%]	[-9.8%,13.2%]
ROOT ROCKY MTN	Cable Mkt Share	0.50	0.0%		1.0%	
DirecTV		[0.44,0.53]	[-5.1%,0.0%]		[-7.0%,2.9%]	
Pop 4.19M	Sat Mkt Share	0.30	0.0%		-0.3%	
WTP $1.79		[0.29,0.33]	[0.0%,4.5%]		[-1.0%,5.6%]	
	Cable Carriage	0.59	0.0%		-17.3%	
		[0.48,0.84]	[-27.5%,0.0%]		[-37.0%,0.0%]	
	Cable Prices	55.84	0.0%		-0.7%	
		[54.03,59.28]	[-0.2%,2.4%]		[-1.5%,3.1%]	
Foreclose: 0%	Aff Fees to Rivals	0.96	0.3%		7.9%	
		[0.26,1.29]	[-0.5%,15.5%]		[4.6%,28.7%]	
	Cable Surplus	13.89	0.0%	-0.1%	-0.4%	-3.1%
		[6.45,15.15]	[-0.8%,0.0%]	[-5.6%,0.2%]	[-1.4%,-0.2%]	[-10.2%,-0.7%]
	Satellite + RSN Surplus	8.90	0.0%	0.2%	-0.9%	-4.3%
		[3.10,9.44]	[-1.2%,3.6%]	[-4.0%,16.9%]	[-2.7%,4.8%]	[-13.9%,22.8%]
	Consumer Welfare	32.59	0.0%	-0.4%	0.3%	4.9%
		[16.28,35.90]	[-2.5%,0.0%]	[-55.1%,0.3%]	[-2.7%,0.9%]	[-63.3%,19.7%]
	Total Welfare	55.38	0.0%	-0.3%	-0.1%	-2.4%
		[25.12,60.28]	[-1.1%,0.0%]	[-47.3%,0.0%]	[-1.3%,0.0%]	[-50.2%,0.1%]
NON-INTEGRATED RSNs (1/4)						
ALTITUDE	Cable Mkt Share	0.54	0.2%		0.1%	
*Comcast		[0.48,0.57]	[-0.9%,6.1%]		[-1.0%,5.2%]	
Pop 7.12M	Sat Mkt Share	0.28	-0.1%		-0.1%	
Footprint 74%		[0.26,0.30]	[-5.9%,0.3%]		[-5.2%,0.4%]	
WTP $3.22	Cable Carriage	0.48	0.0%		0.0%	
		[0.23,0.60]	[0.0%,213.0%]		[0.0%,213.0%]	
	Cable Prices	56.41	-0.1%		-0.1%	
		[54.26,59.69]	[-2.8%,1.2%]		[-2.6%,1.2%]	
Foreclose: 1%	Aff Fees to Sat	1.20	5.0%		33.8%	
		[0.39,1.48]	[-21.2%,10.8%]		[2.0%,52.8%]	
	Cable + RSN Surplus	16.97	0.1%	0.6%	0.7%	3.5%
		[8.43,18.54]	[0.1%,2.4%]	[0.4%,13.2%]	[0.5%,2.9%]	[2.7%,16.5%]
	Satellite Surplus	6.97	-0.4%	-0.8%	-1.7%	-3.6%
		[2.12,7.54]	[-5.8%,0.2%]	[-10.9%,0.4%]	[-5.4%,-0.6%]	[-12.1%,-0.8%]
	Consumer Welfare	32.60	0.1%	0.8%	0.0%	0.4%
		[16.47,36.56]	[-0.2%,3.0%]	[-2.6%,28.9%]	[-1.0%,2.3%]	[-10.0%,26.2%]
	Total Welfare	56.54	0.0%	0.6%	0.0%	0.3%
		[26.28,62.37]	[-0.1%,1.4%]	[-1.2%,23.3%]	[-0.4%,1.1%]	[-6.3%,20.7%]

Notes: Simulated market outcomes across three integration scenarios. “Satellite + RSN Surplus” includes profits for both DirecTV and Dish. See Table 4 for details.

Table A.8: Simulated Market Outcomes for RSNs (4/6)

		(i) No VI	(ii) VI PARs (vs. No VI)		(iii) VI No PARs (vs. No VI)	
		Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
NON-INTEGRATED RSNs (2/4)						
FS DETROIT	Cable Mkt Share	0.56	3.1%		3.0%	
*Comcast		[0.54,0.58]	[0.3%,6.4%]		[0.2%,6.3%]	
Pop 4.84M	Sat Mkt Share	0.17	-3.7%		-3.6%	
Footprint 82%		[0.17,0.18]	[-7.1%,-0.4%]		[-11.8%,-0.3%]	
WTP $4.38	Cable Carriage	0.76	27.6%		27.6%	
		[0.55,0.87]	[6.7%,77.4%]		[6.7%,77.4%]	
	Cable Prices	50.34	-1.0%		-1.0%	
		[49.71,51.44]	[-3.0%,0.1%]		[-2.8%,0.5%]	
Foreclose: 7%	Aff Fees to Sat	2.10	-11.4%		12.7%	
		[0.76,2.69]	[-30.7%,2.4%]		[-14.9%,33.3%]	
	Cable + RSN Surplus	20.37	1.2%	5.6%	1.6%	7.5%
		[9.70,22.30]	[0.3%,2.5%]	[1.8%,11.5%]	[0.7%,3.1%]	[3.7%,13.0%]
	Satellite Surplus	4.38	-2.8%	-2.8%	-4.6%	-4.6%
		[1.33,4.74]	[-4.9%,-0.3%]	[-4.8%,-0.4%]	[-6.8%,-1.4%]	[-6.3%,-1.8%]
	Consumer Welfare	26.64	2.4%	14.4%	2.3%	13.9%
		[13.84,29.68]	[0.2%,5.2%]	[1.4%,30.8%]	[-1.5%,5.0%]	[-9.2%,30.2%]
	Total Welfare	51.38	1.5%	17.2%	1.4%	16.8%
		[24.53,56.31]	[0.2%,3.3%]	[3.7%,38.5%]	[-0.2%,3.2%]	[-2.7%,36.6%]
FS FLORIDA	Cable Mkt Share	0.60	0.8%		0.7%	
*Comcast		[0.59,0.61]	[0.1%,3.4%]		[-0.1%,3.1%]	
Pop 6.20M	Sat Mkt Share	0.23	-0.8%		-0.7%	
Footprint 67%		[0.22,0.23]	[-3.7%,-0.1%]		[-9.6%,0.0%]	
WTP $2.59	Cable Carriage	0.90	2.2%		2.2%	
		[0.53,0.94]	[0.5%,68.6%]		[0.0%,68.6%]	
	Cable Prices	54.19	-0.4%		-0.3%	
		[53.95,54.93]	[-1.4%,0.2%]		[-1.1%,1.0%]	
Foreclose: 9%	Aff Fees to Sat	1.47	-0.7%		25.8%	
		[0.64,1.71]	[-14.1%,5.5%]		[3.3%,40.1%]	
	Cable + RSN Surplus	19.84	0.1%	0.9%	0.6%	4.4%
		[8.90,21.98]	[0.1%,1.6%]	[0.5%,13.0%]	[0.3%,2.1%]	[3.5%,16.5%]
	Satellite Surplus	6.08	-0.8%	-1.9%	-2.2%	-5.2%
		[1.79,6.69]	[-3.3%,-0.2%]	[-9.7%,-0.5%]	[-4.5%,-0.6%]	[-12.8%,-1.3%]
	Consumer Welfare	31.20	0.5%	5.5%	0.4%	4.6%
		[15.35,34.16]	[0.1%,2.4%]	[1.2%,35.4%]	[-2.7%,2.2%]	[-33.2%,32.5%]
	Total Welfare	57.11	0.2%	4.5%	0.2%	3.9%
		[24.93,62.59]	[0.1%,1.3%]	[1.3%,37.2%]	[-1.2%,1.3%]	[-25.1%,35.6%]
FS MIDWEST	Cable Mkt Share	0.60	1.8%		1.7%	
*Comcast		[0.59,0.62]	[0.1%,2.1%]		[0.1%,2.1%]	
Pop 10.40M	Sat Mkt Share	0.21	-1.2%		-1.2%	
Footprint 26%		[0.21,0.21]	[-1.5%,0.0%]		[-1.5%,0.1%]	
WTP $2.44	Cable Carriage	0.43	29.5%		29.5%	
		[0.26,0.55]	[3.3%,51.4%]		[-13.9%,50.4%]	
	Cable Prices	52.15	-0.8%		-0.7%	
		[51.19,52.45]	[-1.0%,0.1%]		[-1.0%,0.1%]	
Foreclose: 0%	Aff Fees to Sat	1.18	-1.5%		17.1%	
		[0.55,1.31]	[-6.5%,3.1%]		[10.5%,31.9%]	
	Cable + RSN Surplus	19.92	0.3%	2.8%	0.6%	4.7%
		[9.44,21.77]	[0.0%,0.6%]	[0.0%,4.8%]	[-0.1%,0.7%]	[-0.9%,6.8%]
	Satellite Surplus	5.26	-1.2%	-2.6%	-2.0%	-4.4%
		[1.69,5.66]	[-1.4%,0.0%]	[-2.7%,-0.2%]	[-2.5%,-0.7%]	[-4.7%,-1.9%]
	Consumer Welfare	29.92	1.3%	15.8%	1.3%	15.6%
		[15.57,33.40]	[0.1%,1.4%]	[1.2%,16.7%]	[0.0%,1.4%]	[0.1%,16.6%]
	Total Welfare	55.10	0.7%	16.0%	0.7%	15.9%
		[26.21,60.16]	[0.1%,0.8%]	[1.3%,16.6%]	[-0.1%,0.8%]	[-2.5%,16.5%]
FS NORTH	Cable Mkt Share	0.61	0.1%		0.1%	
*Charter		[0.59,0.64]	[0.0%,0.7%]		[0.0%,0.7%]	
Pop 5.77M	Sat Mkt Share	0.15	-0.2%		-0.2%	
Footprint 12%		[0.14,0.16]	[-1.4%,0.0%]		[-1.4%,0.0%]	
WTP $4.50	Cable Carriage	0.87	0.0%		0.0%	
		[0.62,0.90]	[0.0%,7.4%]		[0.0%,7.1%]	
	Cable Prices	52.04	-0.1%		-0.1%	
		[50.73,53.33]	[-0.3%,0.1%]		[-0.3%,0.1%]	
Foreclose: 0%	Aff Fees to Sat	2.42	0.5%		7.7%	
		[0.89,3.09]	[-7.1%,1.7%]		[-0.4%,12.6%]	
	Cable + RSN Surplus	23.02	0.0%	0.1%	0.1%	0.6%
		[10.75,25.23]	[0.0%,0.4%]	[0.0%,1.8%]	[0.1%,0.4%]	[0.6%,2.0%]
	Satellite Surplus	3.71	-0.2%	-0.2%	-0.9%	-0.8%
		[1.22,4.00]	[-1.1%,0.0%]	[-0.8%,0.0%]	[-2.0%,-0.5%]	[-1.4%,-0.6%]
	Consumer Welfare	27.70	0.1%	0.6%	0.1%	0.6%
		[14.35,31.04]	[0.0%,0.6%]	[0.0%,3.7%]	[0.0%,0.6%]	[-0.1%,3.6%]
	Total Welfare	54.43	0.0%	0.5%	0.0%	0.5%
		[25.87,59.69]	[0.0%,0.3%]	[0.0%,4.5%]	[0.0%,0.3%]	[-0.1%,3.9%]

Notes: Simulated market outcomes across three integration scenarios. See Table 4 for details.

Table A.9: Simulated Market Outcomes for RSNs (5/6)

		(i) No VI	(ii) VI PARs		(iii) VI No PARs	
			(vs. No VI)		(vs. No VI)	
		Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
NON-INTEGRATED RSNs (3/4)						
FS OHIO	Cable Mkt Share	0.60	2.0%		2.0%	
*TWC		[0.60,0.62]	[0.1%,2.4%]		[0.1%,2.4%]	
Pop 8.16M	Sat Mkt Share	0.18	-1.7%		-1.7%	
Footprint 51%		[0.18,0.18]	[-2.5%,-0.1%]		[-2.6%,0.0%]	
WTP $3.70	Cable Carriage	0.72	5.3%		5.3%	
		[0.41,0.78]	[0.0%,46.0%]		[0.0%,46.0%]	
	Cable Prices	52.43	-1.2%		-1.2%	
		[51.32,52.52]	[-1.3%,0.2%]		[-1.2%,0.3%]	
Foreclose: 1%	Aff Fees to Sat	1.72	2.4%		20.1%	
		[0.75,1.94]	[-7.1%,8.8%]		[5.4%,32.3%]	
	Cable + RSN Surplus	22.39	0.3%	1.6%	0.5%	3.0%
		[10.30,25.14]	[0.0%,1.4%]	[0.3%,9.1%]	[0.3%,1.7%]	[1.7%,10.8%]
	Satellite Surplus	4.47	-1.9%	-2.2%	-3.1%	-3.7%
		[1.39,4.76]	[-2.3%,-0.2%]	[-2.7%,-0.2%]	[-4.0%,-0.6%]	[-3.9%,-0.8%]
	Consumer Welfare	28.65	1.4%	10.7%	1.4%	10.5%
		[15.23,32.22]	[0.1%,2.2%]	[0.7%,17.3%]	[0.0%,2.1%]	[0.3%,16.0%]
	Total Welfare	55.51	0.7%	10.0%	0.7%	9.9%
		[26.41,61.52]	[0.1%,1.4%]	[0.8%,23.9%]	[0.0%,1.4%]	[0.7%,22.4%]
FS SOUTH	Cable Mkt Share	0.62	0.3%		0.3%	
*TWC		[0.61,0.63]	[-0.1%,1.0%]		[-0.2%,1.0%]	
Pop 13.20M	Sat Mkt Share	0.21	-0.7%		-0.7%	
Footprint 33%		[0.21,0.22]	[-1.3%,0.2%]		[-1.3%,0.3%]	
WTP $1.63	Cable Carriage	0.83	12.1%		12.1%	
		[0.58,0.94]	[-7.0%,37.3%]		[-7.1%,37.3%]	
	Cable Prices	55.63	0.0%		0.0%	
		[55.40,56.48]	[-0.6%,0.3%]		[-0.6%,0.3%]	
Foreclose: 0%	Aff Fees to Sat	0.87	-7.2%		5.2%	
		[0.28,0.96]	[-7.1%,5.6%]		[-0.2%,23.1%]	
	Cable + RSN Surplus	22.29	0.3%	4.0%	0.4%	5.5%
		[10.89,24.52]	[-0.2%,0.6%]	[-2.8%,9.1%]	[-0.1%,0.7%]	[-2.9%,10.5%]
	Satellite Surplus	5.76	-0.4%	-1.6%	-0.8%	-3.0%
		[1.80,6.25]	[-1.0%,0.2%]	[-3.7%,0.6%]	[-1.4%,-0.2%]	[-5.0%,-0.8%]
	Consumer Welfare	30.70	0.3%	5.9%	0.3%	5.7%
		[15.81,33.88]	[0.0%,0.8%]	[-0.6%,15.9%]	[0.0%,0.8%]	[-0.8%,15.8%]
	Total Welfare	58.75	0.2%	8.3%	0.2%	8.2%
		[26.82,64.29]	[-0.1%,0.6%]	[-2.2%,23.3%]	[-0.1%,0.6%]	[-3.9%,23.2%]
FS SOUTHWEST	Cable Mkt Share	0.57	2.5%		2.5%	
*Cox		[0.56,0.59]	[0.3%,4.1%]		[0.3%,4.1%]	
Pop 12.70M	Sat Mkt Share	0.23	-1.1%		-1.1%	
Footprint 37%		[0.22,0.23]	[-2.8%,-0.2%]		[-2.6%,-0.1%]	
WTP $3.07	Cable Carriage	1.00	0.0%		0.0%	
		[0.71,1.00]	[-6.3%,28.8%]		[-16.7%,22.3%]	
	Cable Prices	51.20	-1.3%		-1.3%	
		[49.89,51.38]	[-2.0%,0.0%]		[-2.4%,-0.1%]	
Foreclose: 0%	Aff Fees to Sat	1.56	0.1%		8.4%	
		[0.62,1.74]	[-10.4%,3.7%]		[0.1%,21.4%]	
	Cable + RSN Surplus	18.87	0.1%	0.5%	0.2%	1.4%
		[8.25,20.63]	[-0.2%,1.2%]	[-1.5%,7.5%]	[-0.8%,1.0%]	[-5.0%,5.9%]
	Satellite Surplus	5.98	-1.1%	-2.2%	-1.6%	-3.2%
		[1.90,6.39]	[-2.2%,-0.2%]	[-4.5%,-0.4%]	[-2.9%,-0.5%]	[-5.1%,-1.2%]
	Consumer Welfare	29.80	1.3%	12.3%	1.3%	12.2%
		[14.95,33.03]	[0.2%,2.3%]	[1.7%,21.4%]	[0.1%,2.2%]	[1.4%,21.1%]
	Total Welfare	54.64	0.6%	10.6%	0.6%	10.5%
		[24.40,59.98]	[0.1%,1.3%]	[1.3%,23.7%]	[0.0%,1.1%]	[-0.7%,19.2%]
FS WEST	Cable Mkt Share	0.55	5.8%		5.7%	
*TWC		[0.51,0.56]	[0.5%,7.7%]		[0.5%,7.6%]	
Pop 8.43M	Sat Mkt Share	0.25	-4.2%		-4.2%	
Footprint 53%		[0.24,0.26]	[-5.9%,-0.3%]		[-6.2%,-0.2%]	
WTP $4.06	Cable Carriage	0.81	10.0%		10.0%	
		[0.63,0.99]	[-10.8%,37.4%]		[-10.8%,37.4%]	
	Cable Prices	53.50	-2.9%		-2.9%	
		[52.57,55.80]	[-3.9%,-0.1%]		[-3.8%,-0.1%]	
Foreclose: 1%	Aff Fees to Sat	1.82	-2.5%		15.3%	
		[0.67,1.99]	[-12.5%,8.8%]		[-1.7%,36.4%]	
	Cable + RSN Surplus	19.56	1.0%	4.6%	1.3%	6.5%
		[10.03,21.49]	[-0.7%,1.8%]	[-3.6%,9.4%]	[-0.3%,2.2%]	[-1.5%,11.1%]
	Satellite Surplus	6.17	-4.1%	-6.3%	-5.3%	-8.1%
		[1.86,6.68]	[-5.5%,-0.5%]	[-7.9%,-1.0%]	[-6.7%,-1.0%]	[-9.7%,-3.0%]
	Consumer Welfare	32.01	2.6%	20.8%	2.6%	20.5%
		[16.15,35.45]	[0.3%,3.8%]	[2.6%,30.3%]	[0.3%,3.7%]	[2.2%,30.0%]
	Total Welfare	57.75	1.3%	19.1%	1.3%	18.9%
		[26.58,62.69]	[0.0%,1.9%]	[-0.5%,26.9%]	[-0.1%,1.9%]	[-1.7%,26.8%]

Notes: Simulated market outcomes across three integration scenarios. See Table 4 for details.

Table A.10: Simulated Market Outcomes for RSNs (6/6)

		(i) No VI	(ii) VI PARs		(iii) VI No PARs	
			(vs. No VI)		(vs. No VI)	
		Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
NON-INTEGRATED RSNs (4/4)						
MASN	Cable Mkt Share	0.64	4.5%		4.4%	
*Comcast		[0.61,0.66]	[1.0%,5.6%]		[0.9%,5.5%]	
Pop 8.25M	Sat Mkt Share	0.18	-4.1%		-3.9%	
Footprint 52%		[0.17,0.18]	[-7.1%,-1.0%]		[-10.7%,-1.0%]	
WTP $2.21	Cable Carriage	0.51	10.2%		6.1%	
		[0.41,0.71]	[2.6%,39.0%]		[2.2%,39.0%]	
	Cable Prices	56.71	-2.5%		-2.6%	
		[55.59,58.38]	[-2.9%,-0.1%]		[-2.8%,-0.1%]	
Foreclose: 3%	Aff Fees to Sat	1.47	0.2%		27.2%	
		[0.53,1.70]	[-7.4%,6.8%]		[13.9%,38.5%]	
	Cable + RSN Surplus	23.52	0.1%	1.0%	0.3%	3.3%
		[11.47,26.15]	[-0.1%,0.9%]	[-1.6%,8.5%]	[0.1%,1.5%]	[1.3%,16.5%]
	Satellite Surplus	4.44	-4.2%	-8.4%	-5.7%	-11.4%
		[1.34,4.87]	[-6.6%,-0.9%]	[-14.0%,-2.6%]	[-7.5%,-1.5%]	[-16.8%,-4.6%]
	Consumer Welfare	29.80	3.4%	45.3%	3.3%	44.4%
		[15.53,32.88]	[0.8%,4.2%]	[11.3%,65.2%]	[-0.7%,4.2%]	[-9.9%,64.3%]
	Total Welfare	57.76	1.5%	37.9%	1.4%	36.3%
		[27.68,63.28]	[0.4%,1.9%]	[12.7%,51.3%]	[-0.1%,1.9%]	[-1.8%,51.2%]
PRIME TICKET	Cable Mkt Share	0.55	3.2%		3.2%	
*TWC		[0.51,0.56]	[0.4%,7.1%]		[0.5%,6.8%]	
Pop 8.32M	Sat Mkt Share	0.25	-2.2%		-2.2%	
Footprint 53%		[0.24,0.26]	[-4.7%,-0.3%]		[-4.7%,-0.3%]	
WTP $3.11	Cable Carriage	0.79	8.3%		8.3%	
		[0.60,0.87]	[-1.0%,23.8%]		[-1.0%,23.8%]	
	Cable Prices	53.29	-1.7%		-1.7%	
		[52.73,55.97]	[-3.6%,-0.1%]		[-3.3%,-0.1%]	
Foreclose: 1%	Aff Fees to Sat	1.48	0.2%		18.3%	
		[0.59,1.70]	[-8.3%,6.1%]		[3.5%,34.2%]	
	Cable + RSN Surplus	19.19	0.5%	3.0%	0.8%	5.0%
		[9.68,21.21]	[0.0%,1.0%]	[-0.1%,6.5%]	[0.3%,1.5%]	[1.8%,9.7%]
	Satellite Surplus	6.09	-2.2%	-4.3%	-3.2%	-6.2%
		[1.86,6.69]	[-4.6%,-0.4%]	[-9.0%,-1.0%]	[-5.7%,-0.9%]	[-10.5%,-2.7%]
	Consumer Welfare	32.33	1.5%	15.5%	1.5%	15.2%
		[16.15,35.63]	[0.3%,3.5%]	[3.4%,34.9%]	[0.3%,3.4%]	[3.1%,34.6%]
	Total Welfare	57.61	0.8%	14.2%	0.8%	14.1%
		[26.19,62.28]	[0.2%,1.7%]	[3.9%,29.1%]	[0.1%,1.6%]	[3.5%,28.7%]
SUN SPORTS	Cable Mkt Share	0.60	1.4%		1.3%	
*TWC		[0.59,0.61]	[0.1%,2.2%]		[0.1%,2.2%]	
Pop 3.41M	Sat Mkt Share	0.18	-1.2%		-1.2%	
Footprint 65%		[0.17,0.18]	[-1.8%,0.0%]		[-1.8%,0.1%]	
WTP $1.65	Cable Carriage	0.97	0.0%		0.0%	
		[0.84,0.97]	[-2.0%,7.4%]		[-2.0%,7.4%]	
	Cable Prices	55.39	-0.7%		-0.7%	
		[54.84,56.06]	[-1.1%,0.0%]		[-1.1%,0.0%]	
Foreclose: 0%	Aff Fees to Sat	0.62	-0.2%		17.1%	
		[0.29,0.81]	[-5.3%,6.1%]		[8.8%,33.3%]	
	Cable + RSN Surplus	18.85	0.0%	0.3%	0.1%	1.5%
		[8.69,21.04]	[-0.1%,0.5%]	[-1.3%,5.7%]	[0.0%,0.5%]	[-0.2%,7.2%]
	Satellite Surplus	4.61	-1.3%	-3.5%	-1.7%	-4.7%
		[1.36,4.94]	[-1.7%,-0.1%]	[-4.8%,-0.2%]	[-2.3%,-0.3%]	[-6.2%,-1.1%]
	Consumer Welfare	27.02	1.0%	16.9%	1.0%	16.7%
		[13.49,29.81]	[0.1%,1.7%]	[1.5%,26.7%]	[0.0%,1.7%]	[0.5%,26.7%]
	Total Welfare	50.48	0.4%	13.7%	0.4%	13.5%
		[22.93,55.42]	[0.0%,0.9%]	[1.2%,25.2%]	[0.0%,0.9%]	[1.1%,25.1%]

Notes: Simulated market outcomes across three integration scenarios. See Table 4 for details.

Table A.11: Average Simulated Market Outcomes Across All RSNs (Satellite Adjusts Prices)

	(i) No VI	(ii) VI PARs		(iii) VI No PARs			
		(vs. No VI)		(vs. No VI)		(vs. VI PARs)	
	Level	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$	$\%\Delta_{lvl}$	$\%\Delta_{WTP}$
ALL RSNs							
Cable Mkt Share	0.61	1.5%		1.5%		0.0%	
	[0.61,0.62]	[0.2%,2.1%]		[0.4%,2.1%]		[-0.2%,0.2%]	
Sat Mkt Share	0.19	0.0%		-0.5%		-0.5%	
	[0.18,0.20]	[-1.3%,1.1%]		[-2.0%,0.8%]		[-1.2%,0.3%]	
Cable Carriage	0.75	5.8%		5.4%		-0.4%	
	[0.69,0.80]	[4.0%,15.9%]		[3.4%,15.7%]		[-2.4%,1.1%]	
Cable Prices	55.06	-1.1%		-1.0%		0.1%	
	[54.25,55.98]	[-1.5%,-0.1%]		[-1.4%,0.0%]		[0.0%,0.4%]	
Sat Prices	57.75	-0.8%		-1.0%		-0.1%	
	[56.34,61.30]	[-1.5%,-0.1%]		[-1.8%,0.0%]		[-0.5%,0.3%]	
Aff Fees to Rivals	1.48	-1.8%		16.5%		18.2%	
	[0.46,1.76]	[-5.2%,1.7%]		[1.9%,43.0%]		[8.0%,50.3%]	
Cable + RSN Surplus	23.10	0.2%	1.9%	0.5%	4.0%	0.3%	2.1%
	[10.40,25.27]	[0.2%,0.5%]	[0.9%,7.5%]	[0.3%,0.7%]	[1.7%,14.2%]	[0.1%,0.4%]	[0.4%,5.5%]
Satellite Surplus	5.06	-1.9%	-3.7%	-2.8%	-5.4%	-1.0%	-1.7%
	[1.56,5.44]	[-2.8%,-0.5%]	[-9.4%,-0.3%]	[-3.6%,-1.2%]	[-12.1%,-0.9%]	[-1.3%,-0.5%]	[-3.5%,-0.4%]
Consumer Welfare	31.02	1.4%	17.4%	1.2%	15.6%	-0.2%	-1.8%
	[13.10,34.10]	[0.3%,1.8%]	[2.4%,33.4%]	[0.0%,1.6%]	[-0.2%,29.5%]	[-0.7%,-0.1%]	[-10.0%,-0.2%]
Total Welfare	59.17	0.7%	15.7%	0.6%	14.2%	-0.1%	-1.5%
	[24.85,64.45]	[0.2%,0.8%]	[2.6%,32.2%]	[0.1%,0.8%]	[1.4%,29.2%]	[-0.3%,0.0%]	[-8.7%,-0.3%]
# Foreclosed:				4/26 [1,9]			

Notes: Average simulated market outcomes for all RSNs, weighted by the number of households in each RSN's relevant DMAs, where satellite prices are allowed to adjust. See Table 5 and Appendix C.4 for details.

B Necessary Equilibrium Conditions for Affiliate Fee Bargaining

In this section, we describe and analyze an infinite-horizon extensive form bargaining game between non-integrated channels and distributors that can motivate the necessary equilibrium conditions that we employ in our analysis. We do not model a non-cooperative bargaining game within integrated firms, and assume that internal affiliate fees are set in the Nash-in-Nash fashion described in the text. Implicitly we take these internal affiliate fees as given here. We focus on bargaining between representatives for each channel and distributor; as noted in the main text, pricing and carriage decisions, possibly determined by other agents (e.g., local offices of each distributor), are taken as given by these bargaining agents.

Initially, assume that there are no agreements formed between any non-integrated channel and distributor. In each bargaining period, either distributors (in odd periods) or channels (in even periods) simultaneously make private offers to all counterparties with which they have not yet formed an agreement. An offer to form an agreement between a channel c and distributor f specifies a linear affiliate fee τ_{fc} in the set $T_{fc} = [\underline{\tau}_{fc}, \bar{\tau}_{fc}]$, where $\underline{\tau}_{fc} = -a_c$ and $\bar{\tau}_{fc} = \max\{\tau : GFT^M_{fc}(\tau, \underline{\boldsymbol{\tau}}_{-fc}) \geq 0\}$. In each bargaining period, those receiving offers simultaneously announce whether they will accept or reject the offer made to them. At the end of each bargaining period, the set of agreements is observed by all players. Payoffs in a bargaining period depend on the set of agreements in force following that period's bargaining. Once an agreement is reached between c and a distributor g, that agreement remains in force for the remainder of the game. The channel has discount factor $\delta_c \equiv \exp(-r_c\Lambda)$ and each distributor has discount factor $\delta_d \equiv \exp(-r_d\Lambda)$ for $r_c, r_d, \Lambda > 0$, where Λ represents the length of time between periods.[87] We assume that, in any subgame, when receiving off-equilibrium path offers for that subgame, all agents have *passive beliefs*: that is, they continue to believe that other firms have received their equilibrium offers (or no offers at all, if that is what happens on the subgame's equilibrium path).

This setup matches the structure studied by Collard-Wexler et al. (2017), with the exception that we assume firms bargain over linear fees as opposed to lump-sum transfers.

B.1 Nash-in-Nash Conditions are Necessary with Immediate Agreement

In our sample of non-loophole markets, all agreements are reached between relevant RSNs and distributors in each market; we thus focus on equilibria in which all agreements are eventually formed among all channels and distributors. We first show that, when players have passive beliefs in a pure-strategy perfect Bayesian equilibrium, any equilibrium in which all open agreements are immediately formed following any history of play yields the necessary conditions that we employ in estimating our model (under "No Integration" and "VI with PARs"). This result can provide a non-cooperative motivation for the Nash-in-Nash approach we adopt in the text for non-integrated firms in non-loophole markets. Our approach extends results from Collard-Wexler et al. (2017) (in particular, Theorem 4.1) to our setting with linear fees. However, we do not establish conditions under which equilibria must involve immediate agreement; this interesting question is beyond the scope of this paper.

Notation and Assumptions. Assume that Nash bargaining parameters for each non-integrated distributor f and channel c are given by $\zeta_{fc} = r_c/(r_c + r_d)$. We introduce the following notation:

- For any distributor-channel pair $fc \in \mathcal{A}$, where $\mathcal{A}$ represents the set of all non-integrated distributor-RSN pairs, we define the solution to their Nash bargaining problem given all other agreements $\mathcal{A} \setminus fc$ are formed at fees $\boldsymbol{\tau}_{\mathcal{A}\setminus fc} \equiv \{\tau_{gd}\}_{gd\in\mathcal{A}\setminus fc}$ as:

$$\phi^N_{fc}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc}) = \frac{(1-\zeta_{fc})GFT^M_{fc}(0, \boldsymbol{\tau}_{\mathcal{A}\setminus fc}, \cdot) - \zeta_{fc}GFT^C_{fc}(0, \boldsymbol{\tau}_{\mathcal{A}\setminus fc}, \cdot)}{D_f},$$

  where $D_f = \sum_{m\in\mathcal{M}_{fc}} D_{fm}$ (and t subscripts have been removed for this section). Denote by $\tilde{\boldsymbol{\phi}}^N_{fc} \equiv \{\tilde{\phi}^N_{fc}\}_{fc\in\mathcal{A}}$ the vector of Nash-in-Nash fees that solves the fixed point for all agreements; i.e., $\tilde{\phi}^N_{fc} = \phi^N_{fc}(\boldsymbol{\phi}^N_{-fc})\ \forall fc \in \mathcal{A}$. Given our assumptions on firm profits, this vector is unique and can be solved

[87] Our results can straightforwardly accommodate heterogeneous discount factors.

for as the solution to $\tilde{\boldsymbol{\phi}}^N = (\boldsymbol{A}^N)^{-1}\boldsymbol{B}^N$, where each row of vectors $\tilde{\boldsymbol{\phi}}^N$ and $\boldsymbol{B}^N$ and square matrix $\boldsymbol{A}^N$ corresponds to a particular distributor f and channel c pair, and $\boldsymbol{A}^N$ and $\boldsymbol{B}^N$ are functions only of demand terms (which, given fixed downstream prices, are not influenced by affiliate fees), marginal costs, advertising, and bargaining parameters (see (C.36)). We also denote by $\tilde{\boldsymbol{\phi}}^N(\mathcal{B}, \boldsymbol{\tau}_\mathcal{B}) \equiv \{\tilde{\phi}^N_{fc}(\cdot)\}_{fc\in\mathcal{A}\setminus\mathcal{B}}$ the *conditional* Nash-in-Nash vector of affiliate fees given agreements $\mathcal{B} \subset \mathcal{A}$ have been formed at fees $\boldsymbol{\tau}_\mathcal{B} \equiv \{\tau_{gd}\}_{gd\in\mathcal{B}}$. Each element $fc \in \mathcal{A} \setminus \mathcal{B}$ of this conditional Nash-in-Nash vector will satisfy $\tilde{\phi}^N_{fc}(\mathcal{B}, \boldsymbol{\tau}_\mathcal{B}) = \phi^N_{fc}(\{\tilde{\boldsymbol{\phi}}^N_{\mathcal{A}\setminus(B\cup fc)}(\cdot), \boldsymbol{\tau}_\mathcal{B}\})$, and such a vector will also be unique for each $(\mathcal{B}, \boldsymbol{\tau}_\mathcal{B})$.

- Recall that (downstream) distributors make offers in odd periods; (upstream) channels make offers in even periods. For any $fc \in \mathcal{A}$, let $\{\phi^R_{fc,D}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc}), \phi^R_{fc,U}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc})\}$ represent downstream and upstream "Rubinstein fees" that correspond to the odd- and even-period offers that are made in equilibrium in a Rubinstein (1982) alternating offers game between just f and c, given all other agreements in $\mathcal{A}\setminus fc$ have been (or are expected to be immediately) formed at affiliate fees $\boldsymbol{\tau}_{\mathcal{A}\setminus fc}$. Such Rubinstein fees are:

$$\phi^R_{fc,D}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc}) = \frac{\delta_c(1-\delta_d)GFT^M_{fct}(0, \boldsymbol{\tau}_{\mathcal{A}\setminus fc}, \cdot) - (1-\delta_c)GFT^C_{fc}(0, \boldsymbol{\tau}_{\mathcal{A}\setminus fc}, \cdot)}{(1-\delta_c\delta_d)D_f},$$

$$\phi^R_{fc,U}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc}) = \frac{(1-\delta_d)GFT^M_{fct}(0, \boldsymbol{\tau}_{\mathcal{A}\setminus fc}, \cdot) - \delta_d(1-\delta_c)GFT^C_{fc}(0, \boldsymbol{\tau}_{\mathcal{A}\setminus fc}, \cdot)}{(1-\delta_c\delta_d)D_f}.$$

  As with Nash-in-Nash fees, we define $\tilde{\boldsymbol{\phi}}^R_D \equiv \{\tilde{\phi}^R_{fc,D}\}_{fc\in\mathcal{A}}$ and $\tilde{\boldsymbol{\phi}}^R_U \equiv \{\tilde{\phi}^R_{fc,U}\}_{fc\in\mathcal{A}}$ to be the vector of Rubinstein fees that solves the fixed point of the equations above; similarly, these vectors of fees are unique for given discount factors (given pricing and carriage decisions), and can be solved for explicitly as $\tilde{\boldsymbol{\phi}}^R_D = (\boldsymbol{A}^R_D(\Lambda))^{-1}\boldsymbol{B}^R_D(\Lambda)$ and $\tilde{\boldsymbol{\phi}}^R_U = (\boldsymbol{A}^R_U(\Lambda))^{-1}\boldsymbol{B}^R_U(\Lambda)$, where matrices $\{\boldsymbol{A}^R_l(\cdot), \boldsymbol{B}^R_l(\cdot)\}_{l\in\{D,U\}}$ condition on Λ in addition to the terms used in $\boldsymbol{A}^N$ and $\boldsymbol{B}^N$. As before, $\tilde{\boldsymbol{\phi}}^R_D(\mathcal{B}, \boldsymbol{\tau}_\mathcal{B})$ and $\tilde{\boldsymbol{\phi}}^R_U(\mathcal{B}, \boldsymbol{\tau}_\mathcal{B})$ represent the vector of conditional Rubinstein fees for agreements in $\mathcal{A} \setminus \mathcal{B}$ that solve the fixed point of the Rubinstein fee equations above given other agreements in $\mathcal{B}$ have been formed at fees $\boldsymbol{\tau}_\mathcal{B}$.

There are three properties of these fees that will be crucial for our results. First, it will be the case that if a downstream (upstream) firm receives a Rubinstein offer in an even (odd) period and expects that all other agreements will form, that firm will be indifferent between accepting and rejecting the offer:

$$(1-\delta_d)GFT^M_{fc}(0, \boldsymbol{\tau}_{\mathcal{A}\setminus fc}, \cdot) = [\phi^R_{fc,U}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc}) - \delta_d\phi^R_{fc,D}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc})] \times [D_f], \tag{B.23}$$

$$(1-\delta_c)GFT^C_{fc}(0, \boldsymbol{\tau}_{\mathcal{A}\setminus fc}, \cdot) = [\delta_c\phi^R_{fc,U}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc}) - \phi^R_{fc,D}(\boldsymbol{\tau}_{\mathcal{A}\setminus fc})] \times [D_f]. \tag{B.24}$$

I.e., the first equation states that for a downstream distributor f, the one-period change in its gains-from-trade (left-hand side) by rejecting an offer from c (given all other agreements form at fees $\boldsymbol{\tau}_{\mathcal{A}\setminus fc}$) is equal to the difference between anticipated payments it would make if it agreed to upstream Rubinstein fees this period, or downstream Rubinstein fees in the following period (right-hand side). Second, for any $fc \in \mathcal{A}$ and $\boldsymbol{\tau}_{\mathcal{A}\setminus fc}$, $\phi^R_{fc,D}(\cdot) < \phi^N_{fc}(\cdot) < \phi^R_{fc,U}(\cdot)$; and $\lim_{\Lambda\to 0}\phi^R_{fc,D}(\cdot) = \lim_{\Lambda\to 0}\phi^R_{fc,U}(\cdot) = \phi^N_{fc}(\cdot)$. Third, (conditional) Rubinstein fees also converge to (conditional) Nash-in-Nash fees: $\lim_{\Lambda\to 0}\tilde{\boldsymbol{\phi}}^R_D = \lim_{\Lambda\to 0}\tilde{\boldsymbol{\phi}}^R_U = \tilde{\boldsymbol{\phi}}^N$; and $\lim_{\Lambda\to 0}\tilde{\boldsymbol{\phi}}^R_D(\mathcal{B}, \boldsymbol{\tau}_\mathcal{B}) = \lim_{\Lambda\to 0}\tilde{\boldsymbol{\phi}}^R_U(\mathcal{B}, \boldsymbol{\tau}_\mathcal{B}) = \tilde{\boldsymbol{\phi}}^N(\mathcal{B}, \boldsymbol{\tau}_\mathcal{B})$ for any set of agreements $\mathcal{B}$ and affiliate fees $\boldsymbol{\tau}_\mathcal{B}$.[88]

B.1.1 Results.

Before proceeding, we state and prove the following lemma.

Lemma 1. *Consider any set of affiliate fees $\boldsymbol{\tau}^*_\mathcal{A} \equiv \{\tau^*_{fc}\}_{fc\in\mathcal{A}}$ and set of agreements $\mathcal{A}_1 \subset \mathcal{A}$ such that $\mathcal{A}_2 \equiv \mathcal{A}\setminus\mathcal{A}_1$ only contains agreements involving a single channel c. Suppose that (i) $\sum_{m\in\mathcal{M}_{fc}:c\in\mathcal{B}_{gm}}[\Delta_{fc}D_{gm}]/D_f < 1/(\bar{n}_c - 1)$ for all distributors f and g that are present in any of channel c's relevant markets, where $\bar{n}_c$ is the total number of distributors in c's relevant markets; and (ii) $\tau^*_{fc} \geq \phi^R_{fc,D}(\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc})$ $\forall fc \in \mathcal{A}_2$. Then $\phi^N_{fc}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc}) > \phi^N_{fc}(\{\boldsymbol{\tau}^{*,1}_{\mathcal{A}_1}, \{\tilde{\phi}^R_{gc,D}(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})\}_{gc\in\mathcal{A}_2\setminus fc}\})$ $\forall fc \in \mathcal{A}_2$.*

[88]Note that $\lim_{\Lambda\to 0}\boldsymbol{A}^R_D(\Lambda) = \lim_{\Lambda\to 0}\boldsymbol{A}^R_U(\Lambda) = \boldsymbol{A}^{Nash}$ (which is invertible), and $\lim_{\Lambda\to 0}\boldsymbol{B}^R_D(\Lambda) = \lim_{\Lambda\to 0}\boldsymbol{B}^R_U(\Lambda) = \boldsymbol{B}^{Nash}$ (and similarly for the matrices used to compute conditional Rubinstein and Nash fees).

Remark. Condition (i) in the Lemma states that any distributor f that has an agreement with a channel c loses no more than $1/(\bar{n}_c - 1)$ share of its subscribers in c's relevant markets to some rival distributor $g \neq f$ upon disagreement with channel c; we confirm that this condition is satisfied for all distributor-RSN pairs in our analysis.[89]

Proof. Let $n = |\mathcal{A}_2|$ denote the dimension of $\mathcal{A}_2$—i.e., the number of agreements c has open in $\mathcal{A}_2$; and let $D \subset \mathbb{R}^n$ denote the compact set of potential affiliate fees for agreements in $\mathcal{A}_2$. We first prove that the mapping $\Gamma : D \to D$, where $\Gamma(\boldsymbol{\tau}_{\mathcal{A}_2}) = \{\phi^R_{fc,D}(\{\boldsymbol{\tau}^*_{\mathcal{A}_1}, \boldsymbol{\tau}_{\mathcal{A}_2 \setminus fc}\})\}_{fc \in \mathcal{A}_2}$ is a contraction. For any $\boldsymbol{\tau}_{\mathcal{A}_2}, \boldsymbol{\tau}'_{\mathcal{A}_2} \in D$, let $\boldsymbol{d} \equiv \boldsymbol{\tau}_{\mathcal{A}_2} - \boldsymbol{\tau}'_{\mathcal{A}_2}$, and $\boldsymbol{\varepsilon} \equiv \Gamma(\boldsymbol{\tau}_{\mathcal{A}_2}) - \Gamma(\boldsymbol{\tau}'_{\mathcal{A}_2})$. By (C.35) and the definition of $\phi^R_{fc,D}(\cdot)$, we can write:

$$\varepsilon_{fc} = -\frac{(1-\delta_c)}{(1-\delta_c\delta_d)} \times \sum_{g \neq f, m \in \mathcal{M}_{fc} : c \in \mathcal{B}_{gm}} \frac{[\Delta_{fc} D_{gm}]}{D_f} d_{gc} \,.$$

Since $n \leq \bar{n}_c$, condition (i) implies that $\sum_{m \in \mathcal{M}_{fc} : c \in \mathcal{B}_{gm}} [\Delta_{fc} D_{gm}]/D_f < 1/(n-1)$ for all f and $g \neq f$ that have an agreement with c, and we have:

$$\sum_{gc \in \mathcal{A}_2} |\varepsilon_{gc}| \leq \underbrace{\frac{1-\delta_c}{1-\delta_c\delta_d} \times \frac{n-1}{n-1}}_{q} \times \sum_{gc \in \mathcal{A}_2} |d_{gc}| \;;$$

hence $||\boldsymbol{\varepsilon}||_1 \leq q \times ||\boldsymbol{d}||_1$, where $0 \leq q < 1$. Thus, $\Gamma(\cdot)$ is a contraction with a unique fixed point $\tilde{\boldsymbol{\phi}}^R_D(\mathcal{A}_1, \boldsymbol{\tau}^*_{\mathcal{A}_1})$.

Next, note that both $\phi^R_{fc,D}(\cdot)$ and $\phi^N_{fc}(\cdot)$ are increasing in all fees $\{\tau_{gc}\}_{g \neq f}$: as c obtains greater demand from another distributor $g \neq f$ when it disagrees with f, $GFT^C_{fc}(\cdot)$ is decreasing in and $GFT^M_{fc}(\cdot)$ is unaffected by τ_{gc}. If $\tau^*_{fc} \geq \phi^R_{fc,D}(\boldsymbol{\tau}^*_{\mathcal{A} \setminus fc})\ \forall fc \in \mathcal{A}_2$, it follows that $\forall fc \in \mathcal{A}_2$:

$$\begin{aligned} \phi^R_{fc,D}(\{\boldsymbol{\tau}^*_{\mathcal{A}_1}, \boldsymbol{\tau}^*_{\mathcal{A}_2 \setminus fc}\}) &\geq \phi^R_{fc,D}(\{\boldsymbol{\tau}^*_{\mathcal{A}_1}, \{\phi^R_{gc,D}(\{\boldsymbol{\tau}^*_{\mathcal{A}_1}, \boldsymbol{\tau}^*_{\mathcal{A}_2 \setminus gc}\})\}_{gc \in \mathcal{A}_2}\}) \\ &\geq \phi^R_{fc,D}(\{\boldsymbol{\tau}^*_{\mathcal{A}_1}, \{\Gamma^\infty_{gc}(\boldsymbol{\tau}^*_{\mathcal{A}_2})\}_{gc \in \mathcal{A}_2 \setminus fc}) \\ &= \tilde{\phi}^R_{fc,D}(\mathcal{A}_1, \boldsymbol{\tau}^*_{\mathcal{A}_1}) \,, \end{aligned} \tag{B.25}$$

where $\Gamma^\infty(\cdot)$ represents the fixed point of the contraction mapping $\Gamma(\cdot)$. In turn, this implies that:

$$\phi^N_{fc}(\boldsymbol{\tau}^*_{\mathcal{A} \setminus fc}) \geq \phi^N_{fc}(\{\boldsymbol{\tau}^*_{\mathcal{A}_1}, \{\phi^R_{gc,D}(\boldsymbol{\tau}^*_{\mathcal{A} \setminus fc})\}_{gc \in \mathcal{A}_2 \setminus fc}\}) \geq \phi^N_{fc}(\{\boldsymbol{\tau}^*_{\mathcal{A}_1}, \{\tilde{\phi}^R_{gc,D}(\mathcal{A}_1, \boldsymbol{\tau}^*_{\mathcal{A}_1})\}_{gc \in \mathcal{A}_2 \setminus fc}\}) \,.$$

where the last inequality follows from (B.25). $\square$

Remark. Intuitively, the Lemma follows because the Nash bargaining outcome for pair fc involves a lower affiliate fee if c's affiliate fees with other distributors are lower (raising c's gains from trade with f). Condition (ii) in the Lemma implies that downstream Rubinstein fees are lower than τ^*_{fc} for $fc \in \mathcal{A}_2$.

We now state and prove our main result for this subsection:

Proposition 2. *For any $\varepsilon > 0$, there exists $\bar{\Lambda} > 0$ such that for all strictly positive $\Lambda < \bar{\Lambda}$, in any no-delay equilibrium (in which all open agreements in $\mathcal{A}$ immediately form after any history of play) where agreements immediately form at affiliate fees $\boldsymbol{\tau}^{*,1}_{\mathcal{A}}$, $|\tilde{\phi}^N_{fc} - \tau^{*,1}_{fc}| < \varepsilon\ \forall fc \in \mathcal{A}$.*

Proof. We establish this result in two steps.

Step 1: One Channel With Open Agreements in Period 2. Consider a subgame beginning in period 2 in which $\mathcal{A}_1 \subset \mathcal{A}$ agreements have already been formed at affiliate fees $\boldsymbol{\tau}^{*,1}_{\mathcal{A}_1}$, and all open agreements $\mathcal{A}_2 \equiv \mathcal{A} \setminus \mathcal{A}_1$

[89] The maximum number of distributors in any RSN's relevant markets is 7, and the largest predicted share of subscribers lost by a distributor to a rival distributor in an RSN's relevant markets upon disagreement with that RSN is 0.14 (at estimated parameter values); this occurs when Dish does not carry NESN and loses subscribers to Comcast.

involve only a single channel c (who makes offers in this period). In any no-delay equilibrium, all agreements in $\mathcal{A}_2$ immediately form at some set of fees $\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2}$. We prove that as $\Lambda \to 0$, these fees $\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2}$ must be arbitrarilty close to the conditional Nash-in-Nash fees $\tilde{\boldsymbol{\phi}}^N(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})$.

1. First, consider a deviation by some distributor f to reject an offer from c and form an agreement with c in the following period at fees $\phi^R_{fc,D}(\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc})$, where $\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc} \equiv \{\boldsymbol{\tau}^{*,1}_{\mathcal{A}_1}, \boldsymbol{\tau}^{*,2}_{\mathcal{A}_2\setminus fc}\}$; this is the unique subgame outcome with one open agreement (Rubinstein, 1982). For such a deviation not to be profitable, it must be that $\forall fc \in \mathcal{A}_2$:

$$\underbrace{(\tau^{*,2}_{fc} - \delta_d \phi^R_{fc,D}(\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc}))D_f}_{\text{Savings in affiliate fee payments}} \le \underbrace{(1-\delta_d)GFT^M_{fc}(0, \boldsymbol{\tau}^*_{\mathcal{A}\setminus fc})}_{\text{One period gross profit change}}$$

$$(\Leftrightarrow) \qquad \tau^{*,2}_{fc} \le \phi^R_{fc,U}(\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc})$$

where the substitution follows from (B.23).

2. Next, consider a deviation by channel c to not form some agreement $fc \in \mathcal{A}_2$ in period 2 (by demanding from f a sufficiently high fee or simply not making f an offer), but still form all other agreements $\mathcal{A}_2 \setminus fc$ at fees $\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2\setminus fc}$. Following this deviation, channel c expects agreement fc to form in the following period at fee $\phi^R_{fc,D}(\tau^*_{\mathcal{A}\setminus fc})$. Thus, for channel c to not find such a deviation profitable, it must be that:

$$\underbrace{(1-\delta_c)GFT^C_{fc}(0, \boldsymbol{\tau}^*_{\mathcal{A}\setminus fc})}_{\text{One-period gross profit change}} \ge \underbrace{(\delta_c \phi^R_{fc,D}(\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc}) - \tau^{*,2}_{fc}) \times D_f}_{\text{Gains in affiliate fee payments}}$$

$$(\Leftrightarrow) \qquad \tau^{*,2}_{fc} \ge \delta_c \phi^R_{fc,D}(\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc}) - \frac{(1-\delta_c)GFT^C_{fc}(0, \boldsymbol{\tau}^*_{\mathcal{A}\setminus fc})}{D_f}$$

3. Consider now a sequence $\Lambda_k \equiv 1/k$, and period 2 no-delay equilibrium fees $\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2,k}$ associated with Λ_k. Define $f(\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2}) = [\phi^N_{fc}(\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc})]_{fc\in\mathcal{A}_2}$, and functions $g_k(\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2}) = [\delta_c(\Lambda_k)\phi^R_{fc,D}(\tau^*_{\mathcal{A}\setminus fc}; \Lambda_k) - \frac{(1-\delta_c(\Lambda_k))GFT^C_{fc}(0,\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc})}{D_f}]_{fc\in\mathcal{A}_2}$ and $h_k(\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2}) = [\phi^R_{fc,U}(\boldsymbol{\tau}^*_{\mathcal{A}\setminus fc}; \Lambda_k)]_{fc\in\mathcal{A}_2}$. Note that $g_k(\cdot)$ and $h_k(\cdot)$ are continuous and converge uniformly to $f(\cdot)$ as $k \to \infty$, and $f(\cdot)$ has a unique fixed point $\tilde{\boldsymbol{\phi}}^N(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})$. We have shown that $\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2,k} \in [g_k(\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2,k}), h_k(\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2,k})]$ (for $k \ge 2$). Thus, as affiliate fees are restricted to a compact set, it follows that $\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2,k}$ must converge to a fixed point of $f(\cdot)$—i.e., to $\tilde{\boldsymbol{\phi}}^N(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})$ as $k \to \infty$.

Step 2: All Agreements Open in Period 1. Now consider a no-delay equilibrium where all agreements in $\mathcal{A}$ immediately form in period 1 at fees $\boldsymbol{\tau}^{*,1}_{\mathcal{A}}$. We now prove that our proposition holds for offers formed in period 1 (when distributors make offers).

1. First, consider a deviation by some channel c to reject an offer from a distributor f and form an agreement with f in the following period at fees $\phi^R_{fc,U}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc})$ (by the arguments above). For such a deviation to not be profitable, it must be that $\forall fc \in \mathcal{A}$:

$$\underbrace{(1-\delta_d)GFT^C_{fc}(0,\cdot)}_{\text{One period gross profit change}} \quad \ge \quad \underbrace{(\delta_d \phi^R_{fc,U}(\cdot) - \tau^{*,1}_{fc})D_f}_{\text{Gain in affiliate fee payments}}$$

$$(\Leftrightarrow) \qquad \tau^{*,1}_{fc} \ge \phi^R_{fc,D}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc})$$

where the substitution follows from (B.24).

2. Next, we show that for any sequence $\{\Lambda_k\} \to 0$ with $\Lambda_k > 0$ for all k, there exists a corresponding sequence $\{\varepsilon_k\} \to 0$ with $\varepsilon_k > 0$ for all k such that $\tau^{*,1}_{fc,k} \le \phi^N_{fc}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc,k}) + \varepsilon_k \ \forall fc \in \mathcal{A}$. We proceed by contradiction: assume not, so that there exists $\underline{\varepsilon} > 0$ such that for some $\bar{\Lambda} > 0$, for all $\Lambda_k < \bar{\Lambda}$ we have $\tau^{*,1}_{fc,k} > \phi^N_{fc}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc,k}) + \underline{\varepsilon}$ for some $fc \in \mathcal{A}$. Consider now any such Λ_k and a deviation by distributor f to make channel c an unacceptable offer (or no offer at all). Channel c may, upon receiving the

unacceptable offer, reject some set of offers $\mathcal{A}_2$ (that include fc and offers made to it by distributors other than f); all other agreements $\mathcal{A}_1 = \mathcal{A} \setminus \mathcal{A}_2$ form in period 1. Now, observe that there exists a $\bar{\Lambda}' > 0$ such that, for all $\Lambda_k < \bar{\Lambda}'$, for any set of agreements $\mathcal{A}_2 \subseteq \mathcal{A}$ that only involve channel c and include fc:

i. if c rejects agreements $\mathcal{A}_2$ in period 1 and they form in period 2 at equilibrium fees $\boldsymbol{\tau}^{*,2}_{\mathcal{A}_2}$, then $|\delta_d \tau^{*,2}_{fc} - \tilde{\phi}^N_{fc}(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})| < \underline{\varepsilon}/3$ (as we have proven that in any equilibrium, if $\mathcal{A}_2$ only contains agreements involving a single channel, they must form at fees which converge to $\tilde{\boldsymbol{\phi}}^N(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})$);

ii. the absolute value of the one-period gross profit changes for f from $\mathcal{A}_2$ forming is less than $\underline{\varepsilon}/3 \times D_f$ (as profits for f are bounded for any set of finite affiliate fees);

iii. $|\phi^N_{fc}(\{\boldsymbol{\tau}^{*,1}_{\mathcal{A}_1}, \{\tilde{\phi}^R_{gc,D}(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})\}_{gc \in \mathcal{A}_2 \setminus fc}) - \tilde{\phi}^N_{fc}(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})| < \underline{\varepsilon}/3$ (as conditional Rubinstein fees converge to conditional Nash-in-Nash fees).

Then, for any $\Lambda < \min\{\bar{\Lambda}, \bar{\Lambda}'\}$, distributor f's gains from this deviation (regardless of which set of offers $\mathcal{A}_2$ that c rejects) are proportional to (where we suppress the subscript k):

$$
\begin{aligned}
&\underbrace{(\tau^{*,1}_{fc} - \delta_d \tau^{*,2}_{fc}) \times D_f}_{\text{Savings in affiliate fee payments}} \quad -\underbrace{(GFT^M_{f,\mathcal{A}_2}(0, \boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc}) - \delta_d GFT^M_{f,\mathcal{A}_2}(0, \{\boldsymbol{\tau}^{*,1}_{\mathcal{A}_1}, \boldsymbol{\tau}^{*,2}_{\mathcal{A}_2 \setminus fc}\}))}_{\text{One-period gross profit change}} \\
&> \Big(\underbrace{\underline{\varepsilon} + \phi^N_{fc}(\{\boldsymbol{\tau}^{*,1}_{\mathcal{A}_1}, \{\tilde{\phi}^R_{gc,D}(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1})\}_{gc \in \mathcal{A}_2 \setminus fc}\})}_{< \tau^{*,1}_{fc} \text{ by assumption and Lemma 1}} - \underbrace{(\tilde{\phi}^N_{fc}(\mathcal{A}_1, \boldsymbol{\tau}^{*,1}_{\mathcal{A}_1}) + \underline{\varepsilon}/3)}_{> \delta_d \tau^{*,2}_{fc} \text{ by condition (i)}} \Big) \times D_f - (\underline{\varepsilon}/3) D_f \\
&> \Big(\underline{\varepsilon} - \underline{\varepsilon}/3 - \underline{\varepsilon}/3 - \underline{\varepsilon}/3 \Big) \times D_f = 0
\end{aligned}
$$

where the second line follows from our contradictory assumption ($\tau^{*,1}_{fc} > \phi^N_{fc}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc}) + \varepsilon$) and Lemma 1, and conditions (i) and (ii) (where $GFT^M_{f,\mathcal{A}_2}(\cdot)$, representing distributor f's one-period gross profit change from agreements in $\mathcal{A}_2$ forming, does not depend on $\{\tau_{gc}\}_{g \neq f}$); and the last line follows from condition (iii). There is therefore a profitable deviation; contradiction.

3. Consider now any sequence $\{\Lambda_k\} \to 0$ with $\Lambda_k > 0$ for all k, and period 1 no-delay equilibrium fees $\boldsymbol{\tau}^{*,1}_{\mathcal{A},k}$ associated with Λ_k. By the previous step, there exists an associated sequence $\{\varepsilon_k\} \to 0$ with $\varepsilon_k > 0$ for all k such that $\tau^{*,1}_{fc,k} \leq \phi^N_{fc}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc,k}) + \varepsilon_k$ for all $fc \in \mathcal{A}$. Define $f(\boldsymbol{\tau}^{*,1}_{\mathcal{A}}) = [\phi^N_{fc}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc})]_{fc \in \mathcal{A}}$, and functions $g_k(\boldsymbol{\tau}^{*,1}_{\mathcal{A}}) = [\phi^R_{fc,D}(\tau^{*,1}_{\mathcal{A}\setminus fc}; \Lambda_k)]_{fc \in \mathcal{A}}$ and $h_k(\boldsymbol{\tau}^{*,1}_{\mathcal{A}_1}) = [\phi^N_{fc}(\boldsymbol{\tau}^{*,1}_{\mathcal{A}\setminus fc}) + \varepsilon_k]_{fc \in \mathcal{A}}$. Note that $g_k(\cdot)$ and $h_k(\cdot)$ are continuous, converge uniformly to $f(\cdot)$ as $k \to \infty$, and $f(\cdot)$ has a unique fixed point $\tilde{\boldsymbol{\phi}}^N$. We have shown that $\boldsymbol{\tau}^{*,1}_{\mathcal{A},k} \in [g_k(\boldsymbol{\tau}^{*,1}_{\mathcal{A},k}), h_k(\boldsymbol{\tau}^{*,1}_{\mathcal{A}_1,k})]$. Thus, as affiliate fees are restricted to a compact set, it follows that $\boldsymbol{\tau}^{*,1}_{\mathcal{A},k}$ converges to a fixed point of $f(\cdot)$—i.e., to $\tilde{\boldsymbol{\phi}}^N$ as $k \to \infty$.

□

B.2 Negative Three-Party-Surplus as a Necessary Condition for Non-Supply

For the rest of this section, we consider a single channel negotiating with a single cable distributor f and two satellite providers (labeled here as g and g') in an environment where there are no program access rules in effect. Consider the situation in which neither satellite distributor is supplied with channel c and we have equilibrium bundles $\mathcal{B}^o$, bundle prices $\boldsymbol{p}^o$, affiliate fees $\boldsymbol{\tau}^o$, and implied bundle marginal costs $\boldsymbol{mc}^o$.[90] We focus on stationary perfect Bayesian equilibria, in which continuation play depends only on the set of agreements already reached.

We now show that if three-party-surplus, given by the left-hand side of (22), is positive, then there cannot be a perfect Bayesian equilibrium with passive beliefs in the bargaining game described above in which, starting in any subgame with no deals yet reached (including at the start of the game), it is certain

[90] For expositional convenience, we suppress the bargaining with the integrated distributor. The channel's deviation described below could be done once the channel has reached its internal agreement.

that no deals will be reached in the continuation game. To do so, we show that if that was the case, then at channel c's first opportunity to make an offer it could deviate and simultaneously make affiliate fee offers $\tilde{\tau}_{gc}$ to distributor g and $\tilde{\tau}_{g'c}$ to distributor g' having the properties that:

(i) both satellite distributors anticipate greater expected profit by accepting their offer than if no agreements are reached, regardless of each satellite distributor's beliefs regarding whether the other satellite distributor will be supplied;

(ii) channel c's profits are greater if both offers are accepted than if no agreements are reached.

By hypothesis, if channel c makes these offers, then—given passive beliefs—each distributor, say distributor g, believes that the rival distributor g' will not reach an agreement in this bargaining period. Thus, distributor g believes that no deals will be reached in this period if it rejects the offer made to it, and hence no deals will occur in the continuation play either. On the other hand, if g accepts, then while only g will accept this period, once it has accepted channel c and the rival distributor g' may reach a deal in the future. If p_t denotes the probability that a deal is reached between channel c and the rival distributor g' exactly t periods after the deal with g (where $p_0 \equiv 0$), then g's expected payoff from acceptance is a weighted average of its payoffs when only it accepts offer $\tilde{\tau}_{gc}$ and when distributor g is also immediately supplied (recall that g's payoff depends only on whether g' reaches an agreement with channel c, not on the level of the affiliate fee c and g' agree to), where the weight on the latter payoff is $\phi_g \equiv \sum_{t=0} \delta_d^t p_t$. Thus, property (i) implies that distributor g will prefer to accept channel c's offer regardless of its belief about ϕ_g. Since this is true for both distributors, property (ii) implies that the deviation is profitable for channel c.

In the remainder of this appendix we show that if three-party-surplus, given by the left-hand side of (22), is positive and a certain positive margin condition holds (which we verify in our empirical work), then there is a pair of affiliate fees $(\tilde{\tau}_{gc}, \tilde{\tau}_{g'c})$ at which properties (i) and (ii) hold. This motivates our use of negative three-party-surplus as a *necessary* condition for non-supply of both satellite distributors g and g' to be an equilibrium, as otherwise c would find it profitable to make such offers.

Notation. Define

$$\begin{aligned} D_g(\mathcal{A}) &= \sum_m D_{gm}(\mathcal{B}_m^o \cup \mathcal{A}, \boldsymbol{p}_m^o, \cdot) , \\ \pi_g(\mathcal{A}) &= \sum_m D_{gm}(\mathcal{B}_m^o \cup \mathcal{A}, \boldsymbol{p}_m^o, \cdot) \times \underbrace{(p_{gm}^{o,\text{pre-tax}} - mc_{gm}^o)}_{marg_{gm}^o} , \end{aligned}$$

to be distributor g's demand and profits when the distributor-channel pairs contained in $\mathcal{A}$ are added to all bundles; e.g., $D_g(gc, \emptyset) = \sum_m D_{gm}(\mathcal{B}_m^o \cup \{gc\}, \cdot)$ and $D_g(gc, g'c) = \sum_m D_{gm}(\mathcal{B}_m^o \cup \{gc, g'c\}, \cdot)$. Define

$$\begin{aligned} [\Delta_{\mathcal{B}} D_g(\mathcal{A})] &= \sum_m \underbrace{D_{gm}(\mathcal{B}_m^o \cup \mathcal{A}, \cdot) - D_{gm}(\mathcal{B}_m^o \cup \{\mathcal{A} \setminus \mathcal{B}\}, \cdot)}_{\Delta_{\mathcal{B}} D_{gm}(\mathcal{A})} , \\ [\Delta_{\mathcal{B}} \pi_g(\mathcal{A})] &= \sum_m (D_{gm}(\mathcal{B}_m^o \cup \mathcal{A}, \cdot) - D_{gm}(\mathcal{B}_m^o \cup \{\mathcal{A} \setminus \mathcal{B}\}, \cdot)) \times (p_{gm}^{o,\text{pre-tax}} - mc_{gm}^o) , \end{aligned}$$

for $\mathcal{B} \subseteq \mathcal{A}$ to be distributor g's change in demand and profits when the distributor-channel pairs contained in $\mathcal{B}$ are removed from $\mathcal{A}$: e.g., $\Delta_{gc}\pi_g(gc, g'c)$ represents the difference in distributor g's profits from when both g and g' carry channel c versus when only g' carries c (not including and affiliate fees paid to channel c). In terms of notation used in the main text,

$$\begin{aligned} \pi_g(gc, g'c) &\equiv \sum_m \Pi_{gm}^M(\mathcal{B}_m^o \cup \{gc, g'c\}, p_m^o, \boldsymbol{\tau}'), \\ \Delta_{gc,g'c}\pi_g(gc, g'c) &\equiv \sum_m \Delta_{gc,g'c}\Pi_{gm}^M(\mathcal{B}_m^o \cup \{gc, g'c\}, p_m^o, \boldsymbol{\tau}'), \end{aligned}$$

where $\boldsymbol{\tau}' \equiv \{\boldsymbol{\tau}^o \cup (\tau_{gc} = 0, \tau_{g'c} = 0)\}$.

Acceptable Offers. Satellite distributor g will accept an affiliate fee offer $\tilde{\tau}_{gc}$ from channel c and carry the channel if its expected increase in profits from doing so exceeds the expected payments; i.e., if the following inequality holds:

$$\Big(\phi_g \times [\Delta_{gc}\pi_g(gc, g'c)] + (1-\phi_g) \times [\Delta_{gc}\pi_g(gc, \emptyset)]\Big) > \tilde{\tau}_{gc}\Big(\phi_g \times D_g(gc, g'c) + (1-\phi_g) \times D_g(gc, \emptyset)\Big) \ ,$$

where $\phi_g \in [0,1]$ represents distributor g's discounted probability that after accepting deviant offer $\tilde{\tau}_{gc}$ from channel c, the other distributor g' is also supplied. This condition is equivalent to:

$$\tilde{\tau}_{gc} < \frac{\Big(\phi_g \times [\Delta_{gc}\pi_g(gc, g'c)] + (1-\phi_g) \times [\Delta_{gc}\pi_g(gc, \emptyset)]\Big)}{\Big(\phi_g \times D_g(gc, g'c) + (1-\phi_g) \times D_g(gc, \emptyset)\Big)} \ . \tag{B.26}$$

Define

$$A_g \equiv \frac{[\Delta_{gc}\pi_g(gc, g'c)]}{D_g(gc, g'c)} \ , \qquad B_g \equiv \frac{[\Delta_{gc}\pi_g(gc, \emptyset)]}{D_g(gc, \emptyset)} \ .$$

Note that the numerators of both A_g and B_g are positive: i.e., the change in g's profits from carrying channel c equals the increase in g's demand due to carrying channel c multiplied by strictly positive margins in every market (which is the case in the data for both satellite distributors at estimated marginal costs). The derivative of the right-hand side of (B.26) with respect to ϕ_g is weakly positive if $A_g \geq B_g$, and strictly negative otherwise. Thus, if:

$$\tilde{\tau}_{gc}(\varepsilon) = \min\Big(\underbrace{\frac{[\Delta_{gc}\pi_g(gc, g'c)]}{D_g(gc, g'c)}}_{A_g}, \underbrace{\frac{[\Delta_{gc}\pi_g(gc, \emptyset)]}{D_g(gc, \emptyset)}}_{B_g}\Big) - \varepsilon \ , \tag{B.27}$$

for $\varepsilon > 0$, then (B.26) is satisfied for any $\phi_g \in [0,1]$, and g will accept $\tilde{\tau}_{gc}(\varepsilon)$. Define $\tilde{\tau}_{g'c}(\varepsilon)$ similarly.

Profitable for Channel c to Make Offers. Consider now the decision by channel c to offer both satellite distributors the set of affiliate fees $\{\tilde{\tau}_{gc}(\varepsilon), \tilde{\tau}_{g'c}(\varepsilon)\}$ as defined in (B.27), where $\varepsilon > 0$. Assume that the following *positive margin condition* holds:

$$(p^{o,\text{pre-tax}}_{gm} - mc^o_{gm} - \tilde{\tau}_{gc}(0)) > 0 \text{ for all } m,$$

a condition that we have verified holds for each satellite distributor in every market for every RSN when program access rules are not enforced.

We now establish that if three-party-surplus is positive, then c wishes to make such offers; i.e.,:[91]

$$\sum_m \Bigg[[\Delta_{gc,g'c}\Pi^M_{gm}(\{\mathcal{B}^o_m \cup \{gc, g'c\}\}, \cdot)] + [\Delta_{gc,g'c}\Pi^M_{g'm}(\{\mathcal{B}^o_m \cup \{gc, g'c\}\}, \cdot)] \ldots \\ + [\Delta_{gc,g'c}\Pi^C_{cm}(\{\mathcal{B}^o_m \cup \{gc, g'c\}\}, \cdot)]\Bigg] \equiv E > 0 \tag{B.28}$$

implies that, for sufficiently small $\varepsilon > 0$,

$$\underbrace{\sum_m [\Delta_{gc,g'c}\Pi^C_{cm}(\{\mathcal{B}^o_m \cup \{gc, g'c\}\}, \cdot)] + D_g(gc, g'c)\tilde{\tau}_{gc}(\varepsilon) + D_{g'}(gc, g'c)\tilde{\tau}_{g'c}(\varepsilon)}_{\tilde{\Pi}^C(\varepsilon)} > 0 \ ,$$

where all profit changes are evaluated at prices $\boldsymbol{p}^o$ and affiliate fees $\boldsymbol{\tau}'$. Using (B.28) and our previously

[91] For simplicity, we suppress the notation for the arguments of the profit functions; note, however, that, given bundle prices $\boldsymbol{p}^o$, the three party surplus is unaffected by the levels of $(\tau_{gc}, \tau_{g'c})$.

defined notation, the left-hand side of the previous equation can be re-written as

$$\begin{aligned}\tilde{\Pi}^C(\varepsilon) = E &- \Big([\Delta_{gc,g'c}\pi_g(gc,g'c)] - D_g(gc,g'c)\tilde{\tau}_{gc}(\varepsilon)\Big) \\ &- \Big([\Delta_{gc,g'c}\pi_{g'}(gc,g'c)] - D_{g'}(gc,g'c)\tilde{\tau}_{gc}(\varepsilon)\Big)\end{aligned} \tag{B.29}$$

where the terms subtracted from E on the right-hand side are the realized changes in either g or g''s profits when both satellite distributors are supplied with c at affiliate fees $\{\tilde{\tau}_{gc}(\varepsilon), \tilde{\tau}_{g'c}(\varepsilon)\}$. Consider the following two cases:

- If $A_g \leq B_g$, then

$$\begin{aligned}&[\Delta_{gc,g'c}\pi_g(gc,g'c)] - D_g(gc,g'c)\tilde{\tau}_{gc}(\varepsilon) \\ &= [\Delta_{gc}\pi_g(gc,g'c)] + [\Delta_{g'c}\pi_g(\emptyset,g'c)] - D_g(gc,g'c)\frac{[\Delta_{gc}\pi_g(gc,g'c)]}{D_g(gc,g'c)} + D_g(gc,g'c)\varepsilon \\ &= [\Delta_{g'c}\pi_g(\emptyset,g'c)] + D_g(gc,g'c)\varepsilon \\ &\leq D_g(gc,g'c)\varepsilon && \text{(B.30)} \\ &\leq D_g(gc,\emptyset)\varepsilon\ , && \text{(B.31)}\end{aligned}$$

  where the third line follows because $\Delta_{gc,g'c}\pi_g(gc,g'c) = \Delta_{gc}\pi_g(gc,g'c) + \Delta_{g'c}\pi(\emptyset,g'c)$ and from substituting for $\tilde{\tau}_{gc}(\varepsilon)$ from (B.27), using the fact that $A_g \leq B_g$; and the final inequality follows from g obtaining weakly more subscribers when g' doesn't carry c, which implies (under the positive margin condition) that $[\Delta_{g'c}\pi_g(\emptyset,g'c)] \leq 0$.

- If $A_g > B_g$, then:

$$\begin{aligned}&[\Delta_{gc,g'c}\pi_g(gc,g'c)] - D_g(gc,g'c)\tilde{\tau}_{gc}(\varepsilon) \\ &= [\Delta_{g'c}\pi_g(gc,g'c)] + [\Delta_{gc}\pi_g(gc,\emptyset)] - \underbrace{\left(D_g(gc,g'c) - D_g(gc,\emptyset)\right)}_{[\Delta_{g'c}D_g(gc,g'c)]}\tilde{\tau}_{gc}(\varepsilon) - D_g(gc,\emptyset)\tilde{\tau}_{gc}(\varepsilon) \\ &= [\Delta_{g'c}\pi_g(gc,g'c)] - [\Delta_{g'c}D_g(gc,g'c)]\tilde{\tau}_{gc}(\varepsilon) + \underbrace{[\Delta_{gc}\pi_g(gc,\emptyset)] - D_g(gc,\emptyset)\tilde{\tau}_{gc}(\varepsilon)}_{D_g(gc,\emptyset)\varepsilon} \\ &= \left[\sum_m [\Delta_{g'c}D_{gm}(gc, g'^{o,\text{pre-tax}}_{gm} - mc^o_{gm})\right] - [\Delta_{g'c}D_g(gc,g'c)]\tilde{\tau}_{gc}(\varepsilon) + D_g(gc,\emptyset)\varepsilon \\ &= \left[\sum_m \underbrace{[\Delta_{g'c}D_{gm}(gc,g'c)]}_{\leq 0\ \forall m} \times \underbrace{(p^{o,\text{pre-tax}}_{gm} - mc^o_{gm} - \tilde{\tau}_{gc}(\varepsilon))}_{>0\ \forall m}\right] + D_g(gc,\emptyset)\varepsilon \\ &\leq D_g(gc,\emptyset)\varepsilon && \text{(B.32)}\end{aligned}$$

  where the fourth line follows from re-arranging terms, and the last inequality holds under the positive margin condition.

Similar conclusions apply for g' when $A_{g'} \leq B_{g'}$ and when $A_{g'} > B_{g'}$.
Substituting the inequalities in (B.30) and (B.32) for both g and g' into (B.29) implies that:

$$\tilde{\Pi}^C(\varepsilon) \geq E - \varepsilon \times \left(D_g(gc,\emptyset) + D_{g'}(\emptyset,g'c)\right)\ .$$

Thus, if $\varepsilon > 0$, $\tilde{\Pi}^C(\varepsilon) > 0$ for any $\varepsilon \leq E/(D_g(gc,\emptyset) + D_{g'}(\emptyset,g'c))$, and channel c will find it profitable to make offers to g and g' that will be accepted.

Remark. The idea behind this necessary condition is as follows. If a satellite distributor's willingness to pay for channel c is lowest when the rival satellite distributor also has access to channel c, then the affiliate fee offers described above make each satellite distributor indifferent to accepting given that its rival will have access. But its resulting profit level is lower than when neither satellite distributor has access (granting access to just its rival lowers a satellite distributor's profit when margins are positive). As a result, if three-party surplus from supply to both distributors is positive, channel c's profit would increase by making these offers. Suppose, instead, that a satellite distributor's' willingness to pay for channel c is lowest when the rival satellite distributor does not have access to channel c. Then the above offers make the satellite distributor indifferent to accepting if its rival does not have access. But, when its rival does gain access (which happens with these simultaneous offers), each satellite distributor's profit falls below its level when neither has access (given positive margins) and, again, three-party surplus being positive implies that channel c's profit rises when both distributors accept.

C Modeling & Estimation Details

C.1 Ownership and Control Shares

We begin by defining the ownership variables O^M_{fct}, O^C_{fct}, and O^{CC}_{cdt} that we use in our estimation, then discuss the motivation behind these choices, and finally calculate our measures in a few examples.

Definitions. For any MVPD f and channels c and d, we define:

$$
\begin{aligned}
O^M_{fct} &\equiv \frac{\sum_{j\in\mathcal{O}_f}(o_{jft}\times o_{jct})/(o_{jft}+o_{jct})}{\sum_{j\in\mathcal{O}_f}(o_{jft})^2/(o_{jft}+o_{jct})}\ , \\
O^C_{fct} &\equiv \frac{\sum_{j\in\mathcal{O}_c}(o_{jct}\times o_{jft})/(o_{jct}+o_{jft})}{\sum_{j\in\mathcal{O}_c}(o_{jct})^2/(o_{jct}+o_{jft})}\ , \\
O^{CC}_{cdt} &\equiv \frac{\sum_{j\in\mathcal{O}_c}(o_{jct}\times o_{jdt})/(o_{jct}+o_{jdt})}{\sum_{j\in\mathcal{O}_c}(o_{jct})^2/(o_{jct}+o_{jdt})}\ ,
\end{aligned}
$$

where $\mathcal{O}_g$ represents the set of owners of firm g (either MVPD or channel), o_{jgt} represents the ownership share of firm g by owner j, O^M_{fct} represents the ownership coefficient used by an MVPD f when weighting an integrated channel c's profits, O^C_{fct} represents the ownership coefficient used by a channel c when weighting an integrated MVPD f's profits, and O^{CC}_{cdt} represents the ownership coefficient used by a channel c when weighting the profits of a channel d's with which is shares a common owner.

Motivation. For the following discussion, assume that $\mu = 1$.

If vertical integration always involved full ownership there would be no question of how to form firms' objective functions. The difficulty comes when there is partial ownership, such as when an MVPD buys a partial stake in an RSN. In that case, the various owners of the channel may have differing preferences over the actions that the channel should take. While some papers have proposed partial ownership measures (e.g., Bresnahan and Salop, 1986; O'Brien and Salop, 2000), little is known empirically about how conflicting objectives among a firm's owners translates into the firm's behavior.

Our approach to this issue and resulting measures can be understood as follows: consider, as an example, a channel c that is partially owned by an MVPD f (and owned by no other entity with ownership stakes in another distributor or channel). Denote the channel-specific profits as π_c and MVPD-specific distribution profits as π_f. We assume that (the manager of) channel c maximizes an objective that is an ownership-share weighted average (with weights representing "shares of control") of its owners' "normalized" preferences over channel and MVPD distribution profits:

$$
\begin{aligned}
\tilde{\Pi}_{ct} = \sum_j &\underbrace{o_{jct}}_{\text{Ownership Shares}} \underbrace{\left[\frac{o_{jct}}{o_{jct}+o_{jft}}\pi_c + \frac{o_{jft}}{o_{jct}+o_{jft}}\pi_f\right]}_{\text{Relative ``Cash Flows''}} \qquad \text{(C.33)} \\
&\propto\ \pi_c + O^C_{fct}\times\pi_f\ ,
\end{aligned}
$$

where the normalization for each owner j places weights on π_c and π_f that sum to 1. Similar logic underlies the other ownership variables (O^M_{fct} and O^{CC}_{cdt}).

One can imagine various approaches to this issue. Our measures differ from those used in the literature cited above on partial ownership by normalizing cash-flows for each owner (e.g., in (C.33), the weights on π_c and π_f for each owner j sum to 1), and in using ownership shares as the control weights. Recent work by Azar et al. (2016), for example, uses ownership shares as control weights as we do, but does not normalize the cash flows. Absent this normalization, in the above example channel c would maximize instead an objective proportional to $\pi_c + \tilde{O}^C_{fct}\pi_f$, where $\tilde{O}^C_{fct} = (\sum_{j\in\mathcal{O}_c} o_{jct} \times o_{jft})/(\sum_{j\in\mathcal{O}_c} o^2_{jct})$. Of course, these two approaches do not exhaust the possibilities. For example, one could assume that a firm's owners bargain efficiently, resulting in behavior that maximizes their joint payoff. In that case, channel c would maximize an objective proportional to $\pi_c + \overline{O}^C_{fct}\pi_f$, where $\overline{O}^C_{fct} = (\sum_{j\in\mathcal{O}_c} o_{jft})/(\sum_{j\in\mathcal{O}_c} o_{jct})$.

One reason that we depart from these two approaches is that these other measures can lead to some counterintuitive predictions. For example, consider a situation in which an MVPD owns share x of channel c, while N other shareholders each own share $(1-x)/N$ of channel c and nothing else. In that case, $\tilde{O}^C_{fct} = x/(x^2 + (1-x)^2/N)$, $\overline{O}^C_{fct} = 1$, and our measure is $O^C_{fct} = x$. As N goes to ∞, the first measure $\tilde{O}^C_{fct} \to 1/x$. That is, no matter how small the MVPD's ownership share x is, as N gets large the channel's behavior comes to be what the MVPD would want. The N shareholders with common interests are essentially powerless. Indeed, for small x the channel simply maximizes the MVPD's distribution profits. This outcome puts even more weight on the MVPD's distribution profits than the jointly efficient weight $\overline{O}^C_{fct}$, which leads the channel to maximize $(\pi_c + \pi_f)$ regardless of how small the MVPD's ownership share x is. In contrast, in this example our measure puts a weight on the MVPD's distribution profits that equals the MVPD's ownership share in the channel (which is less than the jointly efficient weight).

We next prove an important feature of our measure: if an MVPD and channel share at most a single common owner (i.e., an entity that has positive ownership stakes in both firms), then $O^M_{fct} = O^C_{fct}$.

Lemma 3. *Consider MVPD f and channel c. If there exists at most one owner j such that $o_{jft} \times o_{jct} > 0$, then $O^M_{fct} = O^C_{fct}$.*

Proof. Let $o_{jct} = x$ and $o_{jft} = y$. The numerators for O^M_{fct} and O^C_{fct} are equivalent. The denominator for O^M_{fct} equals $y^2/(x+y) + (1-y)$. The denominator for O^C_{fct} equals $x^2/(x+y) + (1-x)$. Both equal $(x+y-xy)/(x+y)$. □

This property holds for all MVPD and channel pairs that we consider in our analysis.

Finally, note one important empirical advantage of our measure O^C_{fct}: it is invariant to the distribution of ownership among owners with no ownership interests in any other firms within the industry. For example, in the above example, we would also have $O^C_{fct} = x$ if instead there was a single firm owning the $(1-x)$ share of channel c (and nothing else). As a result, we do not need data on the pattern of ownership except that among firms who are vertically integrated.

Examples. We provide two examples of our ownership variables.

1. *Unitary MVPD ownership.* Consider an MVPD f that owns $o_{fct} = x$ share of channel c. In this case, there is a single owner j of MVPD f, where $o_{jft} = 1$. Then the MVPD f places weight O^M_{fct} on channel c's profits (relative to its own profits) when making decisions, where:

$$O^M_{fct} = \frac{(1 \times x)/(1+x)}{(1)/(1+x)} = x \ .$$

For the channel c, there are essentially two owners: one that owns $(1-x)$ of c (and none of MVPD f), and MVPD f that owns x of c. Here, channel c places weight O^C_{fct} on MVPD f's profits (relative to its own profits) when making decisions, where:

$$O^C_{fct} = \frac{(x \times 1)/(1+x)}{(1-x)^2/(1-x) + (x)^2/(1+x)} = \frac{x}{(1+x)(1-x) + x^2} = x \ .$$

Thus, $O^M_{fct} = O^C_{fct}$ when a channel only has a single integrated owner.

2. *Channel Conglomerates.* Assume that a 3rd party owns x share of channel c and y share of channel d. Then channel c places weight O^{CC}_{cdt} on channel d's profits (relative to its own profits) when making decisions, where:

$$O^{CC}_{cdt} = \frac{(x \times y)/(x+y)}{(1-x)^2/(1-x) + (x)^2/(x+y)} = \frac{x \times y}{(x+y)(1-x) + x^2} = \frac{x \times y}{x + y - x \times y} .$$

C.2 Solving for Negotiated Affiliate Fees and Bundle Marginal Costs

We omit the subscript on $\Psi_{fct} \equiv (1-\zeta_{fct})/\zeta_{fct}$ for the expressions in this subsection. Let $\mathcal{B}^R_{fmt}$ be the observed set of RSNs carried by f in market m in period t.

Consider MVPD f bargaining with channel c over affiliate fee τ_{fct}, where c has at most a single integrated owner. Closed form expressions for MVPD and channel "GFT" terms in (9) are:

$$\begin{aligned} GFT^M_{fct} = \sum_{m \in \mathcal{M}_{fct}} \Bigg[& \Big[\mu_{fct} D_{fmt} - D^{\setminus fc}_{fmt}\Big]\tau_{fct} + \mu_{fct} \times (D_{fmt} + \sum_{g \neq f: c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}]) a_{cmt} + \mu_{fct} \sum_{g \neq f: c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] \tau_{gct} \\ & + \sum_{d \in \mathcal{V}_{ft} \setminus c} \sum_{g \in \mathcal{F}_{mt}: d \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] \mu_{fdt} \times (\tau_{gdt} + a_{dmt}) + [\Delta_{fc} D_{fmt}] \Big(p^{\text{pre-tax}}_{fmt} - mc_{fmt}\Big) \Bigg] , \end{aligned} \tag{C.34}$$

$$\begin{aligned} GFT^C_{fct} = \sum_{m \in \mathcal{M}_{fct}} \Bigg[& (D_{fmt} - \mu_{fct} D^{\setminus fc}_{fmt}) \tau_{fct} + (D_{fmt} + \sum_{g \neq f: c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}]) a_{cmt} + \sum_{g \neq f: c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] (\tau_{gct}) \\ & + \sum_{g \in \mathcal{F}_{mt}} \lambda_{R:fct} [\Delta_{fc} D_{gmt}] \sum_{d \in \mathcal{B}_{gmt} \setminus c} \mu^{CC}_{cdt} \times (\tau_{gdt} + a_{dmt}) + \sum_{g \in \mathcal{F}_{mt}} \mu_{gct} \lambda_{R:fct} [\Delta_{fc} D_{gmt}] \Big(p^{\text{pre-tax}}_{gmt} - mc_{gmt}\Big) \Bigg] , \end{aligned} \tag{C.35}$$

where: $D^{\setminus fc}_{fmt}$ is the demand for f in market m if it dropped channel c; $\lambda_{R:fct} = \lambda_R$ if f and c are not integrated, and $\lambda_{R:fct} = 1$ otherwise; $\mu_{fct} = \mu \times O^M_{fct}$; $\mu^{CC}_{cdt} = \mu \times O^{CC}_{cdt}$; and $\mathcal{V}_{ft} \equiv \{c : O_{fct} > 0\}$ is the set of channels owned by MVPD f in period t.

Focus on the bargain between an RSN c and MVPD f.[92] Using (C.34) and (C.35), the Nash Bargaining first-order condition $\forall f \in \mathcal{F}_{mt}, c \in \mathcal{C}^R_t$ given by (10) ($GFT^C_{fct} = \Psi GFT^M_{fct}$) can be re-written as:

$$\begin{aligned} & \tau_{fct} \sum_{m \in \mathcal{M}_{fct}} \Big[(1+\Psi)(1-\mu_{fct}) D_{fmt}\Big] + \sum_{g \neq f: c \in \mathcal{B}_{gmt}} \tau_{gct} \sum_{m \in \mathcal{M}_{fct}} (1 - \Psi \mu_{fct}) [\Delta_{fc} D_{gmt}] \\ & + \sum_{g \in \mathcal{F}_{mt}} \sum_{d \in \mathcal{B}_{gmt} \setminus c} \tau_{gdt} \times ((\Psi - \mu_{fct}) \mathbb{1}_{g=f} + \mu^{CC}_{cdt} - \Psi \mu_{fdt}) \sum_{m \in \mathcal{M}_{fct}} [\Delta_{fc} D_{gmt}] + (\Psi - \mu_{fct}) \sum_{m \in \mathcal{M}_{fct}} mc^{\setminus R}_{fmt} [\Delta_{fc} D_{fmt}] = \\ & \quad \sum_{m \in \mathcal{M}_{fct}} \Big[(\Psi - \mu_{fct}) [\Delta_{fc} D_{fmt}] p^{\text{pre-tax}}_{fmt}\Big] - \sum_{m \in \mathcal{M}_{fct}} \Bigg[a_{cmt} \times \Big((1 - \Psi \mu_{fct}) D_{fmt} + (1 - \Psi \mu_{fct}) \sum_{g \neq f: c \in \mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}]\Big) \\ & \quad + \sum_{g \in \mathcal{F}_{mt}} \sum_{d \in \mathcal{B}_{gmt} \setminus c} a_{dmt} \times (\mu^{CC}_{cdt} - \Psi \mu_{fdt}) ([\Delta_{fc} D_{gmt}])\Bigg] , \end{aligned} \tag{C.36}$$

where $mc^{\setminus R}_{fmt}$ represents non-RSN marginal costs: i.e., $mc^{\setminus R}_{fmt} \equiv mc_{fmt} - \sum_{d \in \mathcal{B}^R_{fmt}} \tau_{fdt}$.

We can also re-write the pricing first-order condition in (5), which provides the optimal set of prices for

[92] In estimation, we are assuming that $\lambda_R = 0$ in the "non-loophole" markets, and thus omit terms that would otherwise enter (e.g., if c were integrated with a rival MVPD f'). In the counterfactuals, we re-introduce these terms.

every cable provider f in every market m, as:

$$\sum_{g\in\mathcal{F}_{mt}} \frac{\partial D_{gmt}}{\partial p_{fmt}} \Big(mc^{\backslash R}_{gmt} \mathbb{1}_{g=f} + \sum_{d\in\mathcal{B}^R_{gmt}} (\mathbb{1}_{g=f} - \mu_{fdt})\tau_{gdt} \Big) = \Big[\frac{D_{fmt}}{1+\text{tax}_{fmt}} + \frac{\partial D_{fmt}}{\partial p_{fmt}} p^{\text{pre-tax}}_{fmt} + \sum_{g\in\mathcal{F}_{mt}} \frac{\partial D_{gmt}}{\partial p_{fmt}} \sum_{d\in\mathcal{B}^R_{gmt}} \mu_{fdt} a_{dmt} \Big] . \tag{C.37}$$

However, if f is a satellite provider (denoted $f \in \mathcal{F}^{sat}$), we assume that there is a single national price p_{ft} and non-RSN marginal cost $\hat{mc}^{\backslash R}_{fmt}$ that applies across all markets; this implies that there is only a single pricing first-order condition for satellite firms:

$$\sum_m \sum_{g\in\mathcal{F}_{mt}} \frac{\partial D_{gmt}}{\partial p_{ft}} \Big(mc^{\backslash R}_{gt} \mathbb{1}_{g=f} + \sum_{d\in\mathcal{B}^R_{gmt}} (\mathbb{1}_{g=f} - \mu_{fdt})\tau_{gdt} \Big) = \sum_m \Big(\frac{D_{fmt}}{1+\text{tax}_{fmt}} + \frac{\partial D_{fmt}}{\partial p_{ft}} p^{\text{pre-tax}}_{ft} + \sum_{g\in\mathcal{F}_{mt}} \frac{\partial D_{gmt}}{\partial p_{fmt}} \sum_{d\in\mathcal{B}^R_{gmt}} \mu_{fdt} a_{dmt} \Big) \qquad \forall f \in \mathcal{F}^{sat} . \tag{C.38}$$

Equations (C.36), (C.37), and (C.38) express affiliate fees and marginal costs as a function of demand parameters, prices, and advertising rates. We thus solve for the vector of RSN affiliate fees $\{\tau_{fct}\}_{\forall f,t,c\in\mathcal{C}^R_t}$ for all RSNs and non-RSN bundle marginal costs $\{mc^{\backslash R}_{fmt}\}_{\forall fmt}$ via matrix inversion when evaluating the objective for any parameter vector $\boldsymbol{\theta}$.

National Channels. We use our estimates of RSN affiliate fees and non-RSN bundle marginal costs to recover $\{\tau_{fct}\}_{\forall ft, c\notin\mathcal{C}^R_t}$ for non-RSN channels via matrix inversion on the following:

$$\begin{aligned} &\tau_{fct} \sum_{m\in\mathcal{M}_{fct}} \Big[D_{fmt} + \Psi D^{\backslash fc}_{fmt} \Big] + \sum_{g\neq f: c\in\mathcal{B}_{gmt}} \tau_{gct} \sum_{m\in\mathcal{M}_{fct}} [\Delta_{fc} D_{gmt}] = \\ &\quad \sum_{m\in\mathcal{M}_{fct}} \Big[\Psi \times [\Delta_{fc} D_{fmt}] (p^{\text{pre-tax}}_{fmt} - \hat{mc}_{fmt}) \Big] + \sum_{g\in\mathcal{F}_{mt}} \sum_{d\in\mathcal{B}_{gmt}\backslash c} \mu_{fdt} \Psi \hat{\tau}_{gdt} \sum_{m\in\mathcal{M}_{fct}} [\Delta_{fc} D_{gmt}] \\ &\quad - \sum_{m\in\mathcal{M}_{fct}} \Big[a_{cmt} \times \Big(D_{fmt} + \sum_{g\neq f: c\in\mathcal{B}_{gmt}} [\Delta_{fc} D_{gmt}] \Big) + \sum_{g\in\mathcal{F}_{mt}} \sum_{d\in\mathcal{B}_{gmt}\backslash c} a_{dmt} \times (-\Psi \mu_{fdt})([\Delta_{fc} D_{gmt}]) \Big] , \end{aligned} \tag{C.39}$$

where we construct estimates of each bundle's marginal costs from our recovered non-RSN marginal costs as follows: $\hat{mc}_{fmt} \equiv \hat{mc}^{\backslash R}_{fmt} + \sum_{d\in\mathcal{B}^R_{fmt}} \hat{\tau}_{fdt}$. We assume away integration incentives for non-RSNs so that $\mu_{fct} = 0 \; \forall ft, c \notin \mathcal{C}^R_t$.

C.3 Further Estimation and Simulation Details

Construction of Disagreement Payoffs. Computation of several moments in estimation require constructing values of $\Delta_{fc}[\Pi^M_{fmt}(\cdot)]$ and $\Delta_{fc}[\Pi^C_{cmt}(\cdot)]$ for each MVPD f and channel c that contract in each period. These "gains from trade" for each pair are functions of both agreement and disagreement profits. Profits from agreement (as a function of $\boldsymbol{\theta}$) are computed using (4) and (7) with observed prices and bundles. Consistent with our timing assumptions (i.e., bundle prices, channel carriage, and affiliate fees are simultaneously determined), profits from disagreement between MVPD f and channel c are computed by removing c from all bundles offered by f and holding fixed: (i) bundle prices for all cable and satellite MVPDs; (ii) carriage decisions for other MVPDs ($\mathcal{B}'_{gmt} = \mathcal{B}_{gmt} \; \forall \; g \neq f$); and (iii) affiliate fees $\hat{\tau}_{-fc,t}$ for all other MVPD-channel pairs.

Importance Sampling. We follow the importance sampling approach of Ackerberg (2009) to estimate our model. We begin by simulating 350 households per market from an initial distribution of random preferences, so that each household is characterized by a vector of preferences for each channel and satellite distributor. For each of these simulated households, we solve the viewership problem given by (1) for each downstream firm in the household's market. To evaluate candidate parameter vectors in the estimation objective function, we approximate the relevant integrals (e.g., for implied market shares or mean viewership by channel) by weighting the initial simulated households by the implied importance sampling weights that depend on the initial distribution and the candidate distribution. For example, if one were to draw from an $N(0,1)$ distribution initially, and want to approximate the mean of an $N(0.5,1)$ distribution, one would put relatively more weight on the initial draws near 0.5, and relatively less weight on negative draws.

The approximation is more accurate the closer is the initial distribution to the candidate distribution. Therefore, we iteratively updated the initial distribution several times through the process. That is, after moving in the parameter space to lower objective function values, we re-simulated an initial distribution from the distribution of preferences implied by the then current best parameter vector.

Estimation of Channel Decay Parameters. We allow for households to have variance in their values of ν^S in order to estimate this parameter using importance sampling. Without allowing for variance in ν^S, we would not be able to obtain any benefits of the importance sampling procedure as we would have to resolve the viewership problem for each simulated household at each objective function valuation. We assume that households' had a value of ν^S drawn from a normal distribution with a common mean and standard deviation of 0.015.

As discussed in footnote 54, we estimate ν^S on a coarse grid (with values contained in $\{0.8, 0.91, 0.95, 0.99\}$); the objective function was minimized for $\nu^S = 0.95$. The computational difficulty of estimating ν^S using the same procedure as with ν^{NS} is the following: with positive variance in both ν^S and ν^{NS}, and given that values of channel viewership utilities $\boldsymbol{\rho}$ are independent of decay parameters, there would commonly be households whose parameter draws implied very unrealistic viewership patterns (e.g., spending 90% of their full day watching a single channel). Such outlier households would imply very inelastic demand for cable or satellite bundles, and consequently implausibly high mark-ups in certain markets. Although these households would have negligible weight absent simulation error, memory and computational limitations prevented us from using more than 350 household simulations per market in estimation.

To examine the sensitivity of our results to different values of ν^S, we have also computed our counterfactual simulations using parameter estimates obtained when $\nu^S = 0.91$ and $\nu^S = 0.99$. In both cases, we find that average simulated changes in surplus or welfare across all RSNs are not statistically different from those reported in Table 5 (which are computed using parameter estimates obtained when $\nu^S = 0.95$); and our main findings do not change.

C.4 Computing Counterfactual Equilibria

For each RSN channel c and each integration scenario—no vertical integration, vertical integration with PARs, and vertical integration without PARs—we compute predicted outcomes in all of the RSN's relevant markets in 2007. We also recompute outcomes for the integration scenario that is "observed" in the data for each RSN.

We maintain the following assumptions: (i) if supplied, satellite distributors carry c in all of c's relevant markets; (ii) cable carriage decisions and affiliate fees for c are allowed to adjust, but those for all other channels are held fixed. In our main counterfactual results (reported in the main text and in Tables A.5-A.10), we allow only cable prices to adjust in each RSN's relevant markets and hold fixed national satellite prices at levels observed in the data. In a robustness test, we allow satellite prices to adjust under the assumption that they are set at the DMA level; results from this specification are reported in Table A.11.

As discussed in the main text and in footnote 72, if we are examining the vertical integration scenario without PARs, we also allow for the channel's supply decision to adjust: e.g., if RSN c is a cable-owned RSN (or is non-integrated and assigned a cable owner under the vertical integration scenarios), we compute outcomes under four "supply scenarios"—the channel is supplied to both satellite distributors, supplied to only DirecTV or Dish, or supplied to neither satellite distributor—and test which supply scenario is robust to deviations by the channel.

For each RSN c, integration scenario, supply scenario, and set of carriage disturbances $\{\Delta_{fc}\omega_{fmt}\}_{f,m}$,[93] we compute outcomes in all of the RSN's relevant markets by iterating over the following procedure until prices, fees, and carriage decisions converge:[94]

1. Given affiliate fees and carriage decisions, we update bundle prices for all cable (and satellite, when appropriate) distributors to maximize profits.
2. Given bundle prices and carriage decisions, we update affiliate fees $\{\tau_{fct}^{CF}\}_f$ using the following system of equations:

$$\begin{aligned}
&\tau_{fct}^{CF}\sum_{m\in\mathcal{M}_{fct}}\Big[(1+\Psi)(1-\mu_{fct})D_{fmt}^{CF}\Big]+\sum_{g\neq f:c\in\mathcal{B}_{gmt}^{R,CF}}\tau_{gct}^{CF}\sum_{m\in\mathcal{M}_{fct}}(1-\Psi\mu_{fct}-\mu_{gct}\lambda_R)[\Delta_{fc}D_{gmt}^{CF}]\\
&+\sum_{g\in\mathcal{F}_{mt}}\sum_{d\in\mathcal{B}_{gmt}^{R,CF}\setminus c}\tau_{gdt}^{CF}\times((\Psi-\mu_{fct})\mathbb{1}_{g=f}+\mu_{cdt}^{CC}-\Psi\mu_{fdt}-\mu_{gct}\lambda_R)\sum_{m\in\mathcal{M}_{fct}}[\Delta_{fc}D_{gmt}^{CF}]=\\
&\sum_{m\in\mathcal{M}_{fct}}\Big[(\Psi-\mu_{fct})(p_{fmt}^{\text{pre-tax},CF}-\hat{mc}_{fmt}^{\setminus R})[\Delta_{fc}D_{fmt}^{CF}]-\mu_{f'ct}\lambda_R\times(p_{f'mt}^{\text{pre-tax},CF}-\hat{mc}_{f'mt}^{\setminus R})[\Delta_{fc}D_{f'mt}^{CF}]\Big]\\
&-\sum_{m\in\mathcal{M}_{fct}}\Bigg[a_{cmt}\times\Big((1-\Psi\mu_{fct})D_{fmt}^{CF}+(1-\Psi\mu_{fct})\sum_{g\neq f:c\in\mathcal{B}_{gmt}^{R,CF}}[\Delta_{fc}D_{gmt}^{CF}]\Big)\\
&+\sum_{g\in\mathcal{F}_{mt}}\sum_{d\in\mathcal{B}_{gmt}^{R,CF}\setminus c}a_{dmt}\times(\mu_{cdt}^{CC}-\Psi\mu_{fdt})([\Delta_{fc}D_{gmt}^{CF}])\Bigg]\qquad\forall f,c\,,
\end{aligned}\tag{C.40}$$

   where f and f' represent the MVPDs with which c is potentially integrated. Equation (C.40) differs from (C.36) insofar as we now allow for the possibility that $\lambda_R > 0$, and that c may be integrated with a rival MVPD f' when bargaining with f. We only update $\{\tau_{fct}\}_{\forall f}$ for the given channel c that is being examined, and not for other channels d that may be active in c's relevant markets.
3. Given bundle prices, affiliate fees, and carriage disturbances, we update carriage decisions by checking in each relevant market whether or not the cable distributor wishes to carry the channel using (20).

[93] We draw a vector of carriage disturbances $\{\Delta_{fc}\omega_{fmt}\}_{f,m}$ for all MVPDs and relevant markets for RSN c, where each element $\Delta_{fc}\omega_{fmt}$ is drawn from a truncated normal distribution with variance $4\hat{\sigma}_\omega^2$ to rationalize observed carriage decisions in the data given by (20). I.e., for every market m where $c\in\mathcal{B}_{fmt}$, we draw $\Delta_{fc}\omega_{fmt}$ conditional on it being less than $\Delta_{fc}\pi_{fmt}^M(\mathcal{B}_{mt},\cdot)$; and for every market m where $c\notin\mathcal{B}_{fmt}$, we draw $\Delta_{fc}\omega_{fmt}$ conditional on it being greater than $\Delta_{fc}\pi_{fmt}^M(\mathcal{B}_{mt}\cup fc,\cdot)$. All counterfactuals outcomes are computed for and averaged over 10 sets of carriage disturbance draws.

[94] We iterate until the sum of absolute differences between all RSN affiliate fees and all downstream prices does not change by more than 10^{-3}.